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I. *On the Power of the Letter* ற. By *Rev.* T. Foulkes, *Church Missionary Society, Madras.*

In most languages there is but one authoritative witness on such a subject as this, namely, prevailing usage. In the case of Tamil letters, although the same usage is still our leading evidence, it does not stand alone : we have also other distinct modes of testing the accuracy of the testimony which it offers, and of interpreting that which is equivocal and doubtful in the depositions.

An appeal to usage alone in the case before us leaves us in uncertainty and apparent contradiction : we need therefore the collateral helps referred to in order to reconcile that contradiction, and, if possible, to arrive at the strict truth respecting the relative position and power of this seemingly anomalous letter.

The Tamil noun ஆறு 'a river' affords an illustration of this apparent difficulty. It would be said that the power of the consonant in question in this word is that of a hard 'r'; and unquestionably it has this pronunciation in common usage. But let this noun be inflected, or compounded with another noun succeeding

it ; for instance with கரை ‘ a bank’; and, after inserting the link-particle அன், we shall have the form ஆற்றங்கரை. In this form the power of the றs would be said to be that of hard ‘ t’s : and yet, from analogy, this doubled form of the letter ought not to be anything more than an intensification of the power of the single letter. The object of the present paper is to endeavour to reconcile this apparent anomaly with the usually beautiful philosophical uniformity observable in similar cases in the structure of the Tamil language; and if possible, to arrive by this means at the true power of this letter ற.

It is perhaps worth remarking thus early, that it is expressly stated in the Nannool that this letter has no equivalent in the Sanscrit alphabet; and when it is remembered that the author of the Nannool, by casting so much of his grammar in a Sanscrit mould, has evidenced an intimate acquaintance with that language, some reliance may be placed on his statement in this respect.

It might be supposed to be conclusive that this letter is a hard ‘ r’ from the fact that it is usually called வல்லின றகரம் by Native scholars, which expression literally means just so much : because it would be tacitly assumed that the converse of this expression would refer to the soft ‘ r’. The fact is, however, that the expression மெல்லின ரகரம் would never be used by a Tamil scholar : for this reason, that the expression வல்லின றகரம் refers only to the fact that ற belongs to the class of letters called வல்லின [hard] ; while its corresponding மெல்லினம் [soft letter] is ன் ‘ n’ : the ர [soft ‘ r’] being referred to the இடையின or ‘ middle letters’ without any relation to ற.

This threefold division of the consonants of the Tamil alphabet is highly scientific, and speaks well of the patient investigation of sounds, the correctness of ear, and the powers of classification of its author in the far-distant age in which he lived. The names, however, which he has handed down to us for these classes are not precise enough for the present requirements of philology. Let us substitute for them the common and more definite terms, surds, nasals, and semi-vowels. For our present purpose we need only to speak of the two former of these. Assuming this primary division to be unexceptionable, we may tabulate the twelve con-

sonants with which we have to do, so as to represent their power simultaneously with their class, as follows :—

	Gutturals	Palatals	Cerebrals	Dentals	Labials	
Surds	க	ச	ட	த	ப	ற
Corresponding Nasals........	ங	ஞ	ண	ந	ம	ன

We arrive in this way at the same conclusion as the Tamil Grammarian, namely, that the letter ற and its corresponding nasal ன are additional letters peculiar to the Tamil language; forasmuch as the ordinary classification of the powers of letters is exhausted before we reach these particular letters, and we have yet to discover a name to express their power.

There is a series of verses in the early part of the Nannool of very great value to all who would acquire a correct pronunciation of the Tamil language, in which the author indicates what he expressively terms the 'birth-place' of the different letters. Amongst them he describes the proper mode of pronouncing the letters ற and ன:—" ற and ன will come forth if the tip of the tongue is brought into close contact with the roof of the mouth." If this be the 'birth-place' of our ற we must once for all give up the thought of its having the power of an 'r' : since there can be no hugging of the roof of the mouth by the tongue in the production of a *trilled* sound, the bare idea of which requires the tongue to be free in the mouth to vibrate the trill.

There are several reasons for supposing that the true power of this letter is that of a 't,' of some modified pronunciation distinct from both the dental 't' (த) and the cerebral 't' (ட):—

1. Each of the surd consonants undergoes certain modifications of its radical pronunciation according to the position which it occupies, and the company in which it is found, in the word of which it forms a part. The forms of pronunciation may be distinguished into hard or radical, soft, and aspirated.

When either of the surds occurs free in the beginning of a word or doubled in the middle of a word, or when it is preceded or

followed by another consonant of the surd class, it bears its hard pronunciation: for instance, க in such circumstances is the equivalent of the English 'k.'

When a surd follows its corresponding nasal, or any other consonant of the nasal class, it bears its soft pronunciation: க in such a position is equivalent to the English 'g.'

Lastly, when a surd follows a vowel or consonant of the semi-vowel class, it bears its aspirated pronunciation: our க has then a light guttural pronunciation, much lighter than the Welsh or even the German 'ch.'

The different surds are susceptible of the aspirated pronunciation, however, in different degrees: in the case of the cerebral ட the aspirated pronunciation is imperceptible, and undistinguishable from its soft pronunciation: in the case of the labial ப that aspirated pronunciation ('ph') begins to grow distinct in some words: in the case of the palatal ச it assumes a more constant form: while in the cases of the guttural க, and the dental த, this aspirated pronunciation is perfect and invariable. The other two pronunciations, namely, the hard and the soft, are invariable admitting of no exceptions and of no degrees.

Applying these rules to the letters ற and ன, we find that ற, when it occurs doubled in the middle of a word, has in common usage a pronunciation which at present it is sufficient to say partakes largely of a 't' sound; and when it follows its corresponding nasal ன it submits to the same rule as the other surds, and softens itself into a kind of 'd.' When, however, it follows a vowel, instead of assuming some kind of aspirated pronunciation of a 't,' singularly enough common usage gives it the pronunciation of a strongly trilled 'r.' Is there not in this exception an intimation that popular usage has in some way corrupted the true pronunciation of the ற in this position? for it does not seem possible to suppose that a trilled 'r' can be the aspirated pronunciation of any description of 't.'

2. Let us put this in a different form. The true radical power of the Tamil consonants is to be discovered in the pronunciation which they bear as the initial letters of words, when they are uninfluenced by the final letters of preceding words. We shall have

greater certainty, however, regarding their power if we assume as our standard the pronunciatiou which these letters bear when they occur doubled in the middle of a word: because in such case the former of the two consonants shuts off all external influence upon its companion, and also assists in bringing out the radical pronunciation of the second letter in its fulness and purity.

In the cases of ட and ற, since they cannot occur as initial letters, we are necessarily obliged to take this second criterion of their power as our only guide.

Judging of our ற by this rule, it will be seen that its hard or radical sound is that of a species of 't,' both as the final consonant of the first of the two syllables of the word in which it is found doubled, and also as the initial consonant of the second of such syllables. And, according to the analogy of all the surd consonants, the other two sounds of which ற is capable are to be regarded as soft and aspirated modifications of that radical sound.

3. The laws of the euphonic changes of final and initial consonants (சந்தி) afford us illustrations in the same direction: ற is treated throughout these rules as if it were a member of the 't' family:—

i. It is almost impossible to pronounce correctly either of the three Tamil 'n's after another 'n' of a different power: provision is accordingly made, when such letters happen to meet, to change the initial 'n' of the second of the two words into an 'n' of the same power as the final 'n' of the word which precedes it. Thus பொன் நன்மை becomes பொன்னன்மை; and மண் நன்மை becomes மண்ணன்மை.

The same reason influences the change of the initial 't' of the second word into a surd of the same power as the final 'n' of the preceding word. Thus மண் தீது becomes மண்டீது; and பொன் தீது becomes பொன்றீது.

The case of the hardening of the final 'n' of the first word into its corresponding surd is subject to the same rule: in that case also the initial 't' of the second word is changed into that particular 't' which corresponds in power with the 'n' so changed, thus producing a doubled 't,' both of which take their radical or

hard pronunciation. Thus மண் தீமை becomes மட்டீமை; and பொன் தீமை becomes பொற்றீமை.

Forasmuch then as these particular changes are applicable to the ' n's and ' t's alone, with only the doubtful exception of ற to be determined, these combinations suggest that this ற also is a surd of the ' t' family, leaving its power yet to be ascertained.

ii. When a word ending in the cerebral ' l' (ள) is followed by a word commencing with a dental ' t' (த), this latter letter is changed into a ' t' of the same power as that of the preceding final ' l,' in order that both letters may be pronounced consecutively from the same ' birth-place,' and the hiatus be avoided which must otherwise occur : and for further euphonic assimilation of the pronunciation, the final ' l' is changed by attraction into the same ' t' as the changed initial ' t' of the second word. Thus முள் தீது becomes முட்டீது. The same process is necessary in the case of the second word having an initial 'n.' Thus முள் நன்று becomes முண்ணன்று.

The same rules hold good when the final consonant of the first word is the second ' l' (ல்) instead of ள். Thus for கல் நன்று we have கன்னன்று ; and for கல் தீது we have கற்றீது.

Forasmuch, therefore, as in the instance of the final cerebral ' l' (ள்) the following initial dental ' t' (த) was changed into a celebral ' t' (ட), analogy suggests that our letter ற into which the same dental ' t' is changed after the other ' l' (ல), is likewise a letter of the ' t' family, and of similar power with this ' l' (ல).

iii. In the case of a final ' t' occurring before an initial surd consonant in the succeeding word, this ' t'—(the dental ' t' (த) is the only one that can well occur in such a position, and that almost exclusively in words of Sanscrit origin—) is changed euphonically into ற். Thus சத் குரு becomes சற்குரு. This also suggests a family connexion between ற and த.

4. The letters த, ட, and ற, with their corresponding nasals, are the usual sign-letters of the past tense of verbs. We have here again a corroboration of the suggestion that these three letters belong to the same family.

5. The fact of the surd consonants which correspond with the dental and cerebral ' n's respectively being ' t's further suggests

that the corresponding surd of the remaining 'n' (ண) is likewise a 't,' and that its power corresponds with the power of ன.

6. A new consideration is afforded in the direction of No. 2 above by the etymological formation of words expressing the lower numerals.

In each of these numeral words from 'one' up to 'ten' we have the combination of a root, and a termination; this termination being in every instance, excepting in நாங்கு 'four,' and possibly also in ஏழு, 'seven,' some modification of the syllable 'tu.'

These forms are divided between the dental து, the cerebral டு, and onr crucial syllable று: the radical form, as we gather from other analogies, being the first of these three, namely து. Thus, we have the dental form, with its hard sound, in பத்து 'ten;' with its soft sound in ஐந்து 'five;' and with its aspirated sound in ஒன்பது 'nine.' Similarly we have the cerebral form, with its hard sound in எட்டு 'eight;' and with its soft sound in இரண்டு 'two.' The third form, namely று, is found with its soft sound in மூன்று 'three,' and—shall it be called its aspirated sound?—in ஆறு 'six.'

Here also, inasmuch as the terminal syllable in all these instances is the modification of their original து, influenced in each case by the character of the last letter of the preceding root-syllable, there seems presumptive grounds for concluding that the று forms in these numeral-words, have some 'tu' power equally with the டு and து forms; and that, consequently, our ற again belongs to the 't' family.

7. It may be well to add here that on the supposition that the trilled sound is the proper pronunciation of ற, the ன alone among the nasal letters stands without a corresponding surd: for a trilled sound is semi-vocalic, and our ற would then have to be classed, not with the surds, as it always has been, but amongst the semi-vowel group.

8. Finally, the only corresponding surd that an 'n' of any power can admit of is a 't' of similar power softened euphonically into 'd.' Since, therefore, ற is unquestionably everywhere treated as the surd corresponding with ன, how can this letter but be regarded as a 't' of the power of this ன, and also of ல?

Supposing that a probable case has been made out to prove that the letter ற is a surd of the 't' family having some power different from த and ட, it remains (a.) to account for its present popular pronunciation; and then (b.) to endeavour to ascertain the particular power of this 't.'

(a.) With regard to the former of these it is not unimportant to remark that there appears to be a certain definite direction in which many letters have a natural tendency to corrupt themselves: and it may be added by the way, that the rules of this species of cacophony, which may probably be found to be applicable to all languages, appear to be well worthy of investigation with a view to assist in determining the etymology of words of corrupted pronunciation whose corruption has been fossilized by a corresponding spelling.—In the particular case of the aspirated sound of a 't' (soft 'th') when it occurs in the middle of a word, (the circumstances of our doubtful ற), there is a considerable tendency amongst uneducated persons and children to change that sound into a trilled one. Instances of this might be pointed out in the English language. In the southern Tamil country, uneducated Native Christians frequently pronounce the பிதா 'Father' of the opening sentence of the Lord's prayer as 'Pira:' போதும், 'enough,' is very commonly pronounced 'Porum' by all classes: and விதை 'seed,' is almost universally pronounced 'Virei' in conversation: and so also of other similar words.

Since, therefore, there is a tendency to corrupt the aspirated sound of one 't' into that of a trilled letter, it becomes not improbable that a 't' of another power may also have been subjected to the same influence. The less easy the proper pronunciation of such a letter, the less likely it would be to save itself from this influence, especially when used by those whose lips and tongue make convenience rather than propriety their rule of utterance: and our ற, being more difficult of pronunciation than the த, would be the more likely to fix itself in that convenient form of corrupted pronunciation towards which it naturally tends.

There seem to be reasons for thinking that illustrations of the position advocated in this paper may be gathered from the Telugu and Canarese languages, in cases of words of the same original

etymology, which are written in Tamil with the ற, but in the above two languages with an unequivocal 't.' I am unable to do more than indicate this source of corroboration on the authority of one, who is acquainted with these languages.

If the supposition of such a corruption as has been indicated is accepted, it may not be impossible to trace progressive degrees in the quantity of the corruption, from its maximum in the case of the single ற after a vowel, through its diminished form in the case of this ற following its nasal, when still, in many cases, a trace of a softened 'r' accompanies the 'd;' down to its minimum in the case of the doubled ற, when usually, though not always, all traces of the 'r' quite disappear. It would seem also as if some of the vowels have a greater propensity than others to cause the appearance of the trill.

(b.) It remains, finally, to endeavour to determine for our ற the peculiar modification of 't' sound which distinguishes it from த and ட. Had the Tamil grammarian been a little more explicit in assigning the particular part of the roof of the mouth which the tongue has to clip in producing this letter and its corresponding nasal, his authority might have decided the matter: but his language is general.

The pronunciation of surd consonants is the result of the emission of the breath through the mouth and lips modified by the position of the tongue in relation to different parts of the mouth, The labial surd ப is the only exception. Excluding this last, the articulation of the other consonants is effected either upon a sudden separation of the *root* of the tongue from the throat, as in 'k,' க; or upon a similar separation of the *body* of the tongue from the palate, as in the case of 'ch,' (as in 'child'), ச; or upon a corresponding separation of the *tip* of the tongue from different parts of the mouth which it is capable of reaching, forming the different 't' sounds.

When the tongue is somewhat curled backwards, and then made to touch the upper part of the palate the cerebral 't' (ட), will be produced. This is the extreme position to which the tip of the tongue can reach backwards in the pronunciation of a 't.' Its extreme position forwards is at the tips of the front teeth: in this

position it pronounces the dental 't' (த). There remains a position midway between these two extremes, namely, the line where the palate meets the roots of the front teeth: this appears to be the proper 'birth-place' of our letter ற; and if so it may consequently perhaps not unaptly be assigned the power of a CEREBRO-DENTAL 't.'

Whether the letter in question ever had in popular usage the pronunciation here claimed for it as its true power, this paper does not profess to enquire; much less to decide on the one side or the other: nor is it intended to express even the whisper of a wish to alter in any way the present popular articulation of the letter. Its sole object has been to endeavour to solve an apparent anomaly in this remarkably regular language, and to ascertain the true place of the letter ற in the classification of the Tamil alphabet. It is sufficient if a *probable* case has been made out in support of the position that, philosophically regarded, this letter is to be classed as a CEREBRO-DENTAL 't.'

II. *On the Photographic delineation of Microscopic objects.* By LIEUT. J. MITCHELL.

I was requested at our last meeting to write a paper on this subject. It is not, I fear, one of very general interest even to Photographers, and I perhaps ought to apologize for troubling you with it. It may however, as suggested by Colonel Hamilton, serve to induce others to give us the benefit of their experience, and if so my labour will not have been altogether useless.

The subject is not a new one, a paper by Mr. Joseph Delves, "On the application of Photography to the representation of Microscopic objects," having been communicated to the Microscopical Society of London in October 1852, it will be found in the transactions of that Society for 1852-53. This was followed by a paper from Mr. G. Shudbolt, a well known Microscopist and Photographer, "On the Photographic delineation of Microscopic objects by artificial illumination," and by another from Mr. S. High-

ley of Fleet Street " On the practical application of Photography to the illustration of works in Microscopy, Natural History, Anatomy, &c., &c." Both these papers were published in the Journal of Microscopical Science for 1853, accompanied by proofs, from Collodion Negatives, of the Tracheæ of the Silk-worm, and a portion of the Proboscis of a Fly: being, I believe, the first Micro-Photographs ever published.

These gentlemen had all restricted themselves to the use of the object glass only, which was applied to use, in various ways, with an ordinary Photographic Camera. Why they discarded the eye-piece I cannot say, as they are silent on that point.

In November 1854, Mr. F. H. Wenham, a gentleman, who, as an amateur optician, has done much for the improvement of the Microscope, read a paper to the Society " On the production of Photographs of Microscopic objects." This gentleman turned the instrument into a solar Microscope, and took his pictures in a dark room, which was in fact his Camera. The prepared paper was placed upon a frame that could be fixed at any convenient distance from the Microscope, which frame also held the paper, or card-board, upon which the object was focused. *He also* dispensed with the eye-piece.

As early as the year 1850, I had expressed (to personal friends) my conviction of the practicability of delineating Microscopic objects by Photography, but it was not until some time in the year 1853, that I, (without knowing that anything of the kind had been attempted elsewhere,) began to apply our delightful art to that purpose. My apparatus was very rude, the Camera having been made for me by a friend whose skill in carpentry was by no means equal to his desire to assist me. With this, however, and a small French Microscope, and with but little knowledge of Photography, I took, by the Calotype process, some negatives, which Captain Tripe considered so promising that he asked me to let him send them to a friend in England who took much interest in such matters. I at that time used both object glass and eye-piece, and on resuming the practice of this branch of Photography in the early part of this year, I adhered to my original plan of using the whole of the Microscope, and not the object glass only, as appears, from

what I have been able to learn, to be still the general practice in England. The only exception I know of, being the Rev. W. T. Kingsley, whose paper upon the subject of Micro-photography, read to the Society of Arts, will be found in No. 8 of the London Photographic Journal.

Mr. Kingsley's name is well known to Microscopists as that of the inventor of a Condenser which bears his name, and he has, I believe, some reputation as a scientific man, and it appears to me very probable, that the complicated additions he thought it necessary to introduce has done much to deter people from the practice of Micro-photography, of which we now very rarely hear any thing. In his paper he describes as necessary,

1st. A set of collecting lenses.

2nd. A set of condensing lenses, of which a separate set was to be provided for each power; although of no use for any other purpose.

3rd. Object glasses very much under-corrected for colour, leaving a strong red fringe, using with these a positive eye-piece with an additional (bi-convex) lens to the Field glass.—The Microscopic object glass is over corrected for colour, this over-correction being rectified by the Huyghenian, or under-corrected. (i. e. non-corrected) Negative eye-piece.

The foregoing and some other complications, which I have not adverted to, were, if not totally unnecessary, certainly sufficient to deter the majority of Photographers from attempting what appeared so difficult.

The illumination of an object when high powers are used is doubtless somewhat difficult, and Mr. Kingsley's condensers would not be objectionable were they achromatic and less expensive; but why he meddled with the optical part of the Microscope itself is to me a mystery, for I find that Ross's Microscope when used with the Huyghenian eye-piece is in the best possible state of correction for Photographic purposes, the visual and actinic foci being absolutely coincident. In a case of this kind an ounce of proof is better than a ship load of argument, and when I say that the pictures I exhibited, and some of which I have brought for examination were taken at the best visual focus I could ob-

tain, I think you will agree with me that it does not seem necessary to meddle with that part of the instrument.

The latest writer upon this subject, Mr. J. R. Traes, has not, I think, added anything of value to our previous store of knowledge. The most remarkable thing in his paper is his great dislike to one of the most valuable adjuncts to a Microscope, viz., a mechanical stage, and his appropriation, without acknowledgment, of Mr. Highley's mode of applying the object glass stage and mirror to the Camera.

Having alluded, as briefly as the subject admitted, to what has been done by others, I will now proceed to describe, as well as I can, my method of working with the compound Microscope and an ordinary Photographic Camera, for which the only additional apparatus required is the following:

1st. A board,* 3 feet 6 inches long, 1 foot wide and 6 inches thick, has at one end a strip of wood nailed (or screwed) on at each side, so as to allow the foot-board, with which most Microscopes in upright cabinets are supplied, to slide easily between them, but without any lateral play. This preserves the true direction of the axis of the Microscope, the prolongation of which, when the body of the instrument is horizontal, should pass perpendicularly through the centre of the focusing screen. The requisite altitude is given to the Camera by erecting at the other end of the board a table on four legs, which are to be secured, by mortising, to the board. The table should be as much larger than the bottom of the Camera as will permit a beading half an inch high to be screwed on all round; the Camera fits tightly within the beading and is thus prevented from moving. Such a board as the above cost me 5 Rupees.

2nd. A cylinder of black cotton velvet, doubled for greater security, somewhat larger in diameter than the flange of the Camera lens, and from 4 to 6 inches long. The flange is unscrewed and loosened sufficiently to tuck one end of the cylinder well in between it and the front of the Camera, the flange is then screwed up tight again, the screws passing through the velvet.

* The size of the board will depend upon the size of the Camera and Microscope.

The other end of the cylinder should be furnished with a drawing string. A new front might be made for this purpose, but it is not necessary, for, if the cylinder of velvet be a little loose, it will not be found at all in the way when the Camera is required for other work.

3rd. There is a difficulty about the focusing screen, and I have not yet found a good material for this purpose. The common ground glass screen forms an infinity of prisms which, when the object is strongly illuminated, as by the sun, render a sharp well defined outline impossible. The iodized and washed collodion plate, recommended by Mr. Shudbolt, is somewhat better, but a focusing screen for the Microscopic Camera is still a desideratum.

The foregoing is all the additional apparatus required. When wanted for use place the platform upon a tolerably firm table in some convenient spot in the open air, as near as possible to the operating room, and if the place selected be such that either sunshine or shade may be had at pleasure, by moving the table a foot or two, so much the better. Little more than the mirror should be exposed to the sun, and this only while focusing, or exposing the plate. At other times the table should be removed into the shade, or the exposed portion of the apparatus should be sheltered by an umbrella held by an assistant, for the intense heat of the sun for any length of time would, in all probability, injure the cementing of the object glasses.

The best general position for the table is parallel with the sun's rays, with the Camera nearest to that luminary. It will be found convenient to place the edge of the board close to the right side of the table, and the end of the Camera flush with the end of the table.

The platform having been thus fixed, put the Camera into its place, and then the Microscope. Having turned the body until it is horizontal, push the foot-board along until the eye-piece is just inside the Camera. Tie the velvet cylinder tightly round the body of the Microscope, and place the focusing screen at ten inches from the focus of the eye-piece.

The usual diameter of the field at ten inches from the lowest eye-piece is five inches, and a square of this size should be mark-

ed upon the focusing screen ; with the deeper eye-pieces, the field is from 8 to 9 inches, and if the Camera admits of a picture of that size being taken, a corresponding square should also be marked on the screen.

Now adjust the mirror so as to throw light into the instrument ; if all has been accurately made and put up, the circle of light will be just contained by its proper square : the apparatus is now ready for use.

The artist need not confine himself to a distance of 10 inches, but that being the distance at which the magnifying power of a Microscope is measured, it is the most convenient for general use, as the amount of amplification will be always known without calculation.

No correction for actinism being required, the object should be focused as for Microscopical examination, i. e. the best visual focus possible should be obtained. The field should be equally illuminated. With the lower powers this is very easy. Use the flat mirror, and if the object slide is covered with paper, adjust it so that a circle of light is thrown upon it, the object being in the centre. If the slide be not covered a piece of paper or a card placed upon it will enable you to see when the light is in the right place. This adjustment will generally be found sufficient, and, if not quite the thing, will require very little alteration.

With powers above the half inch it will be generally necessary to use the achromatic condenser, and here there will be some difficulty in illuminating the field properly, and for reasons that will readily occur to the Microscopist, one of which is, that when a large instrument is put up in this way it is very difficult to reach the mirror and look into the focusing screen at the same time, but by placing the apparatus close to the side and end of the tube, as previously directed, and sitting on a chair at the corner, it can be accomplished with a little patience.

The source of light (when that is the sun) must not be accurately focused upon the object, as it will be reduced by the condenser to a mere point, but the condenser must be racked up or down, (usually the latter) until the best light is obtained.

It will be advantageous to use a focusing glass to examine the image formed upon the focusing screen. Any positive eye-piece

will do for the purpose. I have found Ross's Micrometer eye-piece, with the Micrometer removed, answer very well. The most difficult part of the business is to know when you have got the best focus, for the worst image given by the worst Microscope, is sharper and more free from colour, than any I have yet seen upon the screen. A Rainey's light moderator improves the picture while focusing, but it stops too much light to be used with advantage.

I have not kept a record of the times of exposure of the few plates I have had time to take, but I believe the extremes were 15 seconds and 2 minutes. I think the collodion I used was very insensitive and my Pyrogallic acid was old ; and had probably lost some of its power.

I believe I have nothing more to add, I do not attempt to teach either Photography or the use of the Microscope, but merely to describe a simple and inexpensive method of adapting the two instruments, the Camera and Microscope, for use together.

III. *On Indian Weights and Measures.* By J. W. Breeks, Esq., C. S.

Without attempting a formal review of Mr. Bayley's paper on Indian Weights and Measures, which appeared in No. IV., we desire with a view to encourage discussion and stimulate attention to the subject to say something, in defence of a plan of assimilating Indian to English weights, which plan Mr. Bayley himself has introduced and condemned in the same page.

So as to arrive collectedly at the point of controversy, we subjoin a brief notice of Mr. Bayley's paper and of his mode of treatment. The opening* page states " that no system can be speci-" fied which will not be open to some objections, and the object of " this paper is simply to propose for the consideration of those " interested in the matter, a few different modes of arranging the " weights and measures, in order that the subject may be well

* Madras Journal of Literature and Science, vol. II. No. IV. New Series, p. 183.

" discussed by those qualified to give an opinion before any one " system is authoritatively adopted."

He divides his subject into four heads, and treats them in the order we have written them down.

1. Linear Measure.
2. Superficial do.
3. Weight.
4. Measure of capacity.

Had Mr. Bayley's intention been to set forth a system that would provide a perfect corrective for the metrology of India and England, so that without altering the denominations of the weights and measures in use in either country, they might nevertheless be adjusted in conformity with each other and with some known standard, he could not have advocated a better system than that explained by Captain T. B. Jervis of the Bombay Engineers in his book entitled An Essay on the Primitive Universal Standard of Weights and Measures. But as neither the metrology of England nor the numerous systems of India correspond with Captain Jervis' Primitive Standard, nor are regulated by it, the next best thing to be done is to have some system arranged, which retaining as far as practicable the old Native names and " traditionary standards" will admit of the weights and measures of both countries being in some degree assimilated.

In respect to Linear and Superficial measures, the English systems are already (as Mr. Bayley points out) in extensive use among Natives, and therefore no difficulty need be anticipated in their complete introduction. There is this, moreover, that renders a new system of Linear measure easier of introduction than new measures of weight and capacity, viz., that there is no uncertainty nor mystery about a yard measure. Its exact measure is apparent. It allows of a Native easily comparing its relative length with his own hat'h (cubit), adee (foot) or guz (ell). It creates no doubt in his mind. He can readily test its length (more majorum) by his own forearm. Whereas the exact magnitude or otherwise of measures of weight and capacity cannot be so determined by sight or touch and do not admit of such ready test and verification.

Moreover in regard to superficial measure we may add, that it

does not hold the same important position in respect to the great majority of the people, that the common commercial measures of weight and capacity do. Where the convenience, if nothing more, of every unit of the people would be more or less affected by any change in these latter, perhaps not one in a thousand would care a straw about the introduction of a new system of superficial account.

Mr. Bayley next treats of Weights, (vide p. 186 of No. IV. New Series.)

He first considers an arrangement on the Tola unit, and gives the Calcutta and Madras Tables of weights calculated upon that in accordance with Act VII of 1833, which made the Tola of 180 grains " the unit of a general system of weights in all Government transactions." To both of these Tables, Mr. Bayley objects chiefly because they do not conveniently accommodate themselves to the Imperial Weights of Great Britain. And it is here, to remedy this inconvenience that he casually refers to a plan, of which we desire to say a word in support.

That it is absolutely necessary to have some standard cannot be questioned; for the magnitude or weight of a body can only be understood by comparing it with some other and well known body. Neither can it be questioned, but that it is very desirable to fix upon some standard which is generally accessible and easy of comprehension.

In India, weights have always borne some relation in each district to some coin in circulation there, generally to the one most in repute. In Bengal, Bombay and most parts of the Deccan they conformed to the Rupee. In Madras to the Star Pagoda. In Malwa and other States, otherwise. The Rupee, however, may be said to have been generally the chief standard coin throughout India, and almost everywhere is considered by the Native the standard unit, of which all his weights are certain multiples, and by which all are to be regulated and tested. The Rupee in fact is the Indian traditionary standard unit of weight. And this point is important when we consider that, by the revised Assay Table lately published by the Bombay Government, every conceivable variety of Rupee in regard to weight has been put into cir-

culation from time to time by Native States; this when we come to fix the number of grains that ought to exist in the Tola unit renders it difficult if not impossible to say which is the right and which the wrong number of grains.

The Rupee, as the Tola unit in many different parts of India, has been reported at any number of grains from 170 to 190 and upwards.

Captain Jervis in his Indian Metrology says, that 187·5 grains, as established by Akbar, is the true Tola weight; the seer being 76·8 tolas or 14,400 grains, and the maund 3072 tolas. Probably Mr. Jervis is right, we do not maintain the contrary. It may be perfectly clear to those who investigate the subject that the tola of 187·5 grains is the true and ancient standard by which the coinage and ponderary system of India was and ought to be regulated; but this is just as clear that we have now a Tola unit of 180 grains established by Act; and, even if on other grounds it were desirable to raise this to 187·5 and found a ponderary system thereupon, there would still exist that same objection which Mr. Bayley has taken to our present Tables of weights, viz: want of comformity to the imperial measure of Great Britain.

A ponderary system calculated upon a Tola unit of 187·5 grains results in most inconvenient numbers, as may be seen from the present Calcutta and Madras Tables, which calculated on the same principle, cannot be converted into Avoirdupois without innumerable decimals.

CALCUTTA TABLE.					Equivalent in Eng. lbs.
Grains.	Tolas.	Chittaks.	Seer.	Mun.	lbs.
187·5 =	1	..	..	..	
937·5 =	5 =	1	..	..	
150,000 =	80 =	16	= 1	.....	2·142857
6,000,000 =	3,200 =	640	= 40	= 1..	85·71428 &c

Madras Table.									Equivalent in Eng. lbs.
Grains.		Tolas.		Pollams.		Viss.		Maund.	lbs.
187·5	=	1		..		..		..	
5625	=	3	=	1		..		..	
22,500	=	120	=	40	=	1		.....	3·2142857
180,000	=	960	=	320	=	8	=	1 ..	25·7142857

The adoption therefore of the true and original unit of 187·5 grs. would not, it is evident, lead to such a simple and uniform ponderary arrangement as would admit of easy conversion into the imperial weights of Great Britain.

But although a tola of 187·5 grs. does not answer our purpose in every respect we do not see the objection to the adoption of another No. (and especially of one that is found to correspond with the average weight of old Native rupees) which does answer in all respects. No objection at any rate could be made to such a course on the score of tradition or prejudice or anything of that kind, for there have been rupees of all weights. And the argument seems plausible which contends, that where each district would seem to have had its own standard tola it would be our best plan, if any change is contemplated, to select such a number for our standard as,

1st, would be acceptable to the inhabitants and so convenient that the weights which are multiples of the unit would be easily convertible into Avoirdupois,

And, 2nd, as will most approximate the average weight of old Native Rupees, on which the different native systems of weights have been calculated, and interfere as little as practicable with the present, and existing Native weights which have the prescriptive sanction of long usage.

As far as the second point goes, the present Tola of 180 grs. would seem to meet all the conditions, but the great objection remains that the weights calculated therefrom cannot be conveniently converted into English weights, and we scarcely think Mr.

Bayley's plan of retaining the present tola weight and altering the seer to $77\frac{3}{4}$ tolas satisfactorily removes all objection. Firstly, a seer of $77\frac{3}{4}$ tolas will not meet with ready acquiescence from the Natives, and therefore will not be found easy of introduction ; and secondly, it is open to minor objections which we think might be avoided by the adoption of another plan. Such for instance as a plan founded upon the traditionary standard of the country and which would enjoy these advantages, viz: that it retained the seer of 80 tolas the best known weight in India, and that the present Government Tables of weights (which are now extensively known) calculated thereupon would readily conform to English weights. Mr. Bayley himself points out some of the objections to which a seer of $77\frac{3}{4}$ tolas is open. At page 189, he says "a seer of 80 tolas could no doubt be more easily introduced throughout India than any other weight." At page 196 referring to the result of a special enquiry instituted by the Madras Board of Revenue in 1852, he tell us "that as a general rule it was found that the seer weight was that of 80 tolas." Now we know the inveteracy of ancient custom in these kind of things and how difficult it is to introduce a change. People are always ready enough to admit the change to be for the better, and that it is very advisable to put an end to doubts and differences and to have one uniform system throughout, and yet these admissions are never acted upon and never ripen into practice. And, thus, we fear that the idea of a seer of 80 tolas has obtained such root in India that one of $77\frac{3}{4}$ tolas would have a hard chance of any extensive introduction however desirable on other grounds.

Some years ago the present Tables of the Goverment of India and of the Madras Government were introduced, and though the latter corresponds, as Mr. Bayley says, with the present Native systems of weights it is not used to any extent except in Government transactions. Even in England there was occasion for the passing of innumerable Acts of Parliament to put an end to the confusion arising from the use of weights of the same name but different magnitude, and till of late years the Acts produced little effect. In India if any change *very* apparent to the Natives and militating against mâmool is attempted, no number of Acts will effect a

general introduction of the change. It becomes therefore a point of extraordinary importance that in the proposed change everything, as far as possible, should run consonant with Native notions of weights and measures. Any intelligent Native will tell you a seer weight is 80 tolas, but perhaps not 2 in 20 would agree as to the exact number of grains that made a tola. But setting aside this consideration for the present the chief objection to a seer of 77¾ tolas is, as Mr. Bayley himself says, that it does not admit of subdivision, you cannot well halve it, and any other sub-multiple is proportionately more intricate and fractional. Besides this as regards the opportunity of easily testing the seer we scarcely think a ¼ of a Rupee can be considered "just as much a coin of defined weight as the whole rupee." It is so at present when it leaves the Mint, although it has been recommended, and supported by the Government, that the smaller coins should be issued in the form of tokens at a fictitious value and weighed in the gross. The two anna pieces are now no longer adjusted individually. But, at any rate, by reason of the thinness of the metal the ¼ Rupee can never receive so bold an impression as the Rupee, in consequence of which and the greater circulation it undergoes it wears faster and lasts a shorter time than the Rupee and (*a fortiori*) is not so convenient a standard.

Moreover, Mr. Bayley's seer of 77¾ tolas does not conform exactly to English Avoirdupois. It would be 5 grains short, he says, (p. 193) of 2lbs., but nevertheless he would have it defined legally equal to 2lbs. 5 grains is a very small difference, but whether in practice it would be found immaterial we are not prepared to say. The best Mercantile Firms dispute over the 1-16th and 1-20th of a penny in the exchange with England. In such transactions it would be difficult to draw a line and say what fractional difference ceases to be of importance. The following plan, of Mr. Bayley, of keeping the present tables with the same denominations and relative magnitudes but reducing the Rupee, the standard unit, to 175 grains (retaining the same amount of pure silver 165 grains) appears to us the easiest of introduction and the most practicable. By it two objects would be gained.

1. The retention of the present system of weights which are now widely known, and which correspond in some degree to the best known Native systems.

2. Assimilation with, and easy convertibility into, English Avoirdupois.

We subjoin the Calcutta and Madras Tables reckoned at 175 grains the tola. On the right are the equivalents of the several weights in English lbs. On the left are the number of grains the several weights are now considered to contain with the tola equal to 180 grains; this arrangement is made for easy comparison with the number of grains they will severally contain with the tola equal to 175 grains.

Madras Table of Weights with Tola equal to 175 *grains.*

Number of grains containing now.	Grains.	Tolas.	Pollum.	Viss.	Maund.		Equivalent in English lbs.
180	175=	1					1-40th
540	525=	3=	1				3-40th
21600	21000=	120=	40=	1			3
172800	168000=	960=	320=	8=	1		24

In Southern India a seer of 24 tolas called a *Cutcha seer* is very prevalent—it is equal to 24-40ths of a lb; this and the Bengal seer of 2lbs. might be introduced into the Table something in this way:

175 grains	=	1	tola.
3 tolas	=	1	pollum.
8 pollums	=	1	cutcha seer.
40 tolas	=	1	lb.
2 lbs.	=	1	Bengal seer.
$1\frac{1}{2}$ Bengal seer	=	1	viss.
8 viss	=	1	maund.

Bengal Table of Weights with Tola equal to 175 grains.

Number of grains containing now.	Grains.	Tolas.	Chittaks.	Bengal seer.	Mun.		Equivalent in English lbs.
180	175=	1					1-40th
900	875=	5=	1				
14400	14000=	80=	16=	1			2
576000	560000=	3200=	640=	40=	1		80
		By this arrangement			25=	would equal	2000

the proposed New Ton.

The Bengal Table might be written in this way,—

175 grains = 1 tola.
5 tolas = 1 chittak.
8 chittaks = 1 ℔.
2 ℔ = 1 Bengal seer.
40 Beng. seers = 1 mun.
25 mun. = 1 ton.

The Calcutta and Madras Tables amalgamated make,—

175 grains = 1 tola.
5 tolas = 1 chittak.
8 chittaks = 1 ℔.
2 ℔s. = 1 seer, (Bengal)
1½ Beng. seer = 1 viss.
8 viss = 1 maund.
3½ Maund or 80 ℔s. = 1 mun.
25 muns. = 1 ton.

Mr. Bayley, however, says it seems impracticable to reduce the Rupee to 175 grains; if this is the case of course all advocacy is at an end. But, *prima facie*, it appears to us more feasible to reduce the unit of weight, which the great bulk of the people know nothing about, from an arbitrary number selected by ourselves to a number more in accordance with the average weight of Rupees of Native Governments, than to alter the relative values of weights higher up the scale which they do know something about, and have an obstinate prejudice for, having daily occasion to make use of

them. Practically, whether the Rupee weighs 175 grains or 180 grains, so long as the quantity of pure silver remains the same, seems of little importance. All coins in circulation suffer wear and tear and diminish in weight, and yet people in their every day transactions never think of testing the weight of each piece. At least it is many years before a coinage will arrive at such a stage that pieces are rejected as light; and they will be light many more grains than five when such is the case, the remedy allowed in the weight of the present Rupee is $1\frac{1}{2}$ grains, so it is possible even with the present coinage *when it leaves the Mint* that one coin may be 3 grains heavier or lighter than another. The proposed change is only 5 grains. In practice no difference will be observed, that so accustomed are people to attach a particular value to certain coins in circulation.* It is only when coins are brought into exchange with the coins and commodities of a foreign country that any so slight a deviation (as proposed) from what has existed, would be taken into account, and in this matter the proposed change to a Rupee of 175 grains, of which 165 are pure silver, would work in our favor. For just as a depreciated currency produces an adverse rate of exchange, a currency of greater fineness will raise the rate. With a Rupee weighing 175 grains, *cæteris paribus*, the par of exchange with England (calculated at the usual rate 6*s*. per oz. of silver) would be raised from 1*s*. 9·29625*d*, the present par to 1*s*. 10·29875*d*, (*i. e.*) could be raised more than a penny.

		grs.		dwts.		dwts.
Ex..	Gross weight.	175	*i. e.*)	226·2857	are pure out of	240
	Pure Silver..	165	(*i. e.*)	4·2857	better call it, 4·29 B.	

* Formerly, it is true, Rupees were distinguished by the years in which they were coined, that is to say, they bore the impression of the year of the reigning King of Delhi in which they were struck, and after 4 or 5 years suffered a depreciation and became what are called *Sonat* Rupees or *Rupees of years*. But the depreciation was more nominal than any thing else and arose from the acts of money lenders more than from any intrinsic depreciation in the coin itself. The different coins usually passed current indiscriminately especially if the impression of the Sonat Rupee happened to be so effaced as not to recall the year in which it was struck.

175 4·29 —— 1575 350 200 —— 222) 750·75 (3·39	175 × 3·39 = 178·39 equivalent weight in Standard Silver. Standard Silver at 60*d.* per oz.: or ·125*d.* per grain 178·39 × ·125 = 1*s.* 10·29875*d.*

As regards prices the trifling alteration proposed would have no effect at all probably. For as on one hand a man buying a pound of sugar for a Rupee would get 200 grains less weight of sugar for his Rupee than formerly, which is tantamount to a rise in prices, so on the other hand the value of the Rupee, by its greater fineness, being somewhat enhanced in the eyes of the foreigner would gradually become more appreciated at home and the holder of a Rupee would demand more than a pound of sugar in exchange for his coin, which is tantamount to a fall in prices. This fall and rise would destroy each other. A distant and defined date should be named upon which the change was to come into effect. Otherwise any sudden introduction would work as a fraud upon all creditors. A is debtor to B for one viss of sugar to be supplied on a certain day. Between the contract and its execution the Standard unit is reduced. A viss formerly consisted of 21,600 grains now only of 21,000. B is defrauded of 600 grains.

Or, some such regulation might be passed that it was not to affect existing contracts, but be only prospective ; in the interim Rupees of 175 grains might be coined at once and issued for circulation, the collectors being ordered to shroff their remittances to the Presidency so as to send down none but old Rupees. In this way, though it would take some time, Rupees of 180 grains would gradually be drawn out of circulation and Rupees of 175 grains be introduced.

Mr. Bayley lastly considers the measures of capacity. The most common measure, he tells us, is the seer measure, which, when heaped will contain a seer weight of rice or non-danium. Setting aside the arbitrary and undefined kind of an idea a *heaped* measure gives one, Government as Mr. Bayley says could not "lend a sanction to it." Nevertheless in this also it would be as well to diverge as little as possible from the principle of the

traditionary standard by which Natives are accustomed to test the correctness or otherwise of their seer measure. Their standard has always been that a seer measure when *heaped* should contain a seer weight of rice or non-danium; the new standard might be that a seer measure when struck should contain this. This might be accomplished, the seer weight of 80 tolas being retained by adopting Mr. Bayley's plan of a quart seer, which when *struck* contains 80 tolas of non-danium.

The quart seer with the tola of 175 grs. will not contain *exactly* 97 tolas of water, at a temperature of Fahrenheit, as is the case Mr. Bayley says (though we cannot make it out so*) with the tola of 180 grs. We do not see however that this matters much. For all ordinary test the knowledge that a quart seer contains, when struck, a seer weight of non-danium should be sufficient. If nicer accuracy is required, its exact measure can be determined by its capacity to hold distilled water, in which case a decimal more or less in the operation is of little importance.

IV. *The Cairns of Tinnevelly.* By *the* Rev. J. T. Kearns, *Missionary, S. P. G., Madras.*

During the hot season of the present year 1859, I was obliged to visit Courtallum, a place in the Talúq of Tencasey in the Zillah of Tinnevelly; while there, the kindness of the Acting Collector, V. H. Levinge, Esq., enabled me to inspect some excavations which were being carried on in the lawn, in front of his residence. In the course of the excavations the workmen met with several large earthen urns, closely imbedded in stones, but unfortunately they destroyed most of them, either through carelessness or from not knowing their value. On personally inspecting the place I discovered that they had penetrated several Cairns, in each of which

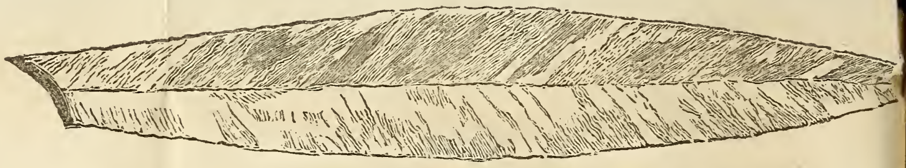
* Vide Table in appendix to Mr. Bayley's paper, at 84° Fah.; a gallon of distilled water weighs 70,000—151·85=69848·150

∴ a quart weighs 17462·038.

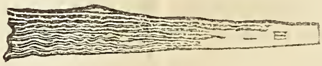
17462·038÷180=97·011.

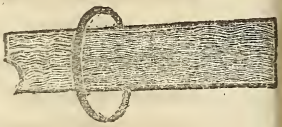
was an urn about 4 feet in height, and about 3 feet in its greatest diameter. Each urn had been closely surrounded by a chamber of *unhewn* stones, boulders, such as are at present procurable in the bed of the adjoining river. The urns were without ornament of any kind, except that the mouths of them were encircled by a bead moulding. I examined them carefully, hoping to discover some inscriptions upon them but in vain. The only *marks* or *figures* upon them were upon the inside and close to the edge. They were thus, on one side " "—directly opposite—" " The lines forming these figures were each about 3 inches long. The manufacture of the *urns* was coarse, *strength* and not beauty of finish, having been evidently the object of the manufacture. On turning out the clay with which the urns were filled, here and there I discovered small layers of *bone* completely pulverized, but to my mind entirely forbidding the idea that they had ever been submitted to fire. If I am right these Cairns differ in a very material point from the Cairns which have been discovered in Ireland, with which I am better acquainted than with any others. However I do not contend for this. At the bottom of the urns were discovered several weapons, all of iron, but from being imbedded in clay, reduced almost, with few exceptions, to bare oxide. Such as they are, however, they claim for the age to which they belong considerable acquaintance with the arts: one of them, that which I have denominated in the drawing a hog spear, is not exceeded in manufacture by weapons of that kind now in use among the Natives. The large oblong pieces of iron (one of which is encircled by a moveable ring) marked in the drawing (XX) were also found in the urns, but of their use I am ignorant. I would hazard a conjecture, however, and call them *Axes.* In addition to the weapons, several small earthen vessels of most exquisite manufacture were also found; of their original use it is impossible now to conjecture almost, but I would observe that, in some of the Irish Cairns, vessels similar to the *cup*, have been found, and are called by the Irish Antiquaries "*Lachrymatories.*" Whether *this* vessel was appropriated to such a purpose I do not determine. The *pottery* of the small vessels is exactly like that of vessels which I have seen from Cairns on the Annamalies and Nilgiris.

BRITISH MUSEUM
NATURAL HISTORY.

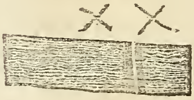


Spearhead.—In good preservation.





Sword.



Fractured.

Hog-Spear.

POTTERY.

URNS.

WEAPONS AND POTTERY

Discovered in Cairns in the Garden of V. H. Levinge, Esq., at Courtal

My first impression on inspecting these Cairns was, that they are the sepulchres of the chiefs of the Aborigines; for they closely resemble the Cairns of the *Aborigines* of Ireland, wanting, however, that which would put the question beyond doubt, namely, any *primitive* weapon, such as a *flint* spear head, weapons which are invariably found in the Irish Cairns. Yielding to the doubt which this circumstance, and the apparently superior finish of the weapons and pottery (superior to any thing Aborigines generally are found to possess) gave rise to, I felt inclined to assign to them a Budhic or Jainer origin, especially as the urns correspond *exactly* with others discovered by me at a place about 40 miles N. W. of Tuticoreen, and of whose Budhic or Jainer origin there can be no doubt, as they are found in a place, traditionally spoken of as having once been a great Budhist town, but of which, the only vestige now remaining is an image of Budh or the Jainer *Maha Véra.* This image, I would remark here, is of enormous size; in its sitting posture it is above the height of an ordinary man, and is hewn out of one solid block of mountain granite, it is in a field, exposed to the ravages of man and of the weather, but is well worthy a place in any museum: there is not the slightest obstacle to its removal. However, there is an objection to the theory that these Cairns are Jainer, namely, the urns, of whose Jainer origin there can be no doubt, are *not* surrounded with stone chambers, whereas the Courtallum urns *are*, in this particular, resembling the Cairns of the Irish Aborigines, and, per consequence, in claiming an early date; but the absence of primitive weapons, as well as the superior finish of those which have been found some way destroying this claim to antiquity. I should observe that at Courtallum I have not found as yet any traces of the Budhic or Jain worship. Whereas in the North of Tinnevelly, not far from the place where stands the celebrated image which I have alluded to there is a Sooprumanian temple which abounds in Jainer figures cut in the solid rock in alto-relievo, though at the present day there is not a Jainer to be found in these parts. I would observe in conclusion, that the Courtallum Cairns had no perpendicular stones about them; if there ever had been any we should not wonder at their removal, as they are just the thing which Natives would appropriate to them-

selves. I have not so much endeavoured to explain to my readers the character, &c. &c. of these Cairns, as to inform them that such have been discovered in Tinnevelly, the first, I believe, which have been discovered so far south.

V. *Memorandum on the Syrian and Jewish Copper Plates of Malabar.** By KOOKEL KELOO NAIR, *District Moonsiff in Malabar.*

[We have given insertion to the following paper, not more on account of the interesting nature of the subject to which it relates than in consequence of the merit attaching to it as the work of an entirely self-taught Native Gentleman. But, we do not therefore affirm or support the conclusions he has drawn, as we know that some persons, competent to discuss the matter, are inclined to consider these to be untenable. We shall be happy to give insertion to any remarks of our contributors to the chronological theory here advocated. —ED. M. L. S. J.]

THE narrow but very long strip of country stretching along the coast from Cape Comorin to Gokurnom is called Kerala, and also Parasoo Rama Kshetrom (Parasoo Ramen's country). Of this, the tract of land intervening from the river Canjarote Pooya (the original southern boundary of Canara) to Travancore, inclusive, is now called Malayalam (or the country below the Ghauts) and by the English generally, the Malabar Coast.

Kerala was one of the 56 districts of the Bharata-division or Hindostan, and equally with the rest of it was civilized to a certain degree long before many of the other nations of the earth had first begun to be civilized, and ever since has never once been destitute of a ruler or of some form of Government; but the vanity, the many superstitions, and gross idolatry, (opposed alike to their own Vedanta and natural reason) of the rulers and their subjects, have never, up to the present date, permitted that early civilization to attain perfection. The inhabitants of Kerala may

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* Vide this Journal N. S. Vol. IV. p. 152, and also the O. S. No. 30, June 1844.

yet however justly claim to be admitted to be a people of ability and intellect.

The whole of the original Kerala was ruled by Parasa Ramen, and afterwards by the Brahmins established there by him, but the greater portion, that is to say, the southern part of it, was after some time ruled by Peroomals or Viceroys sent at the desire of the Brahmins by the Rajahs of Salem, and each of whom governed for the space of 12 years, being subject to certain regulations of the Brahmins, but in fact having the superior authority. This species of mixed Government appears from several circumstances and other proofs, to have commenced 68 years before the Christian era, and ended about A. D. 352. The names of the 37 Peroomals who ruled during this period are still to be found in the old records of the history of the country. From this time till Hyder Ally's usurpation in A. D. 1766, the ancestors of the present nominal Rajahs unquestionably ruled over the country with some slight interruptions from the Portuguese subsequently to A. D. 1498.

The above narrative (the outline of which may be gleaned, though with difficulty it is true, from various old works, however overlaid the history in those works may be with fables) is very fully illustrated by the following trustworthy Deeds on Copper, viz., No. I. dated as will be hereafter shown, without doubt in A. D. 230, No. III. apparently dated in A. D. 168, and No. II., which from certain circumstantial evidence it may be concluded was executed about A D. 321. It is also corroborated by a European named Cona Thoma, who testifies that he saw the last Peroomal at Cranganore (Codungalore) in A. D. 345.

These three Copper Plate Documents are still extant being preserved respectively by the Jews and by Nasaránies or Syrian Christians of Malabar. Of these deeds two were executed by the Peroomals themselves with the knowledge and concurrence of the Brahmins and Chieftains before alluded to, and granted to certain individuals mentioned therein; and the other was granted by Marmvan Sapir Iso to a Church called Tarisa Pully built by Isodata Veeray, and was executed in conjunction with the then Venaad Adigul or Chief, now called the Travancore Rajah. From fear of mis-

construction, the former two have been numbered I and III, and the last II precisely as was previously done in the Madras Literary Journal No. 30 of June 1844, page 115 to 146.

It may be inferred from the Kerala Mahátingam (a very loose and vague Sanskrit Book) that this country derived its name *Kerala* from one *Veera Kerala*, the first Prince who governed it. It is, though, the opinion of some that as this country abounds with cocoanut trees, termed in Sanskrit Kera, it owes its name to that circumstance. But, though what the Kerala Mahatinayam relates might be accepted, seeing that the Copper Plate Document No I. proves that Veera Kerala was the first Prince of Kerala; yet on the other hand there may be no harm in surmising, that this name of Veera Kerala may have had reference to the said country of *Kerala* which he governed.

It is difficult to learn clearly the history of the family of this Veera Kerala, but from various Sanskrit and other works such as the Mahatinayam, Ulpati and others, it appears pretty clearly, if we reject obvious fables, that Parasoo Rama a Brahmin eventually gained possession of the country from Veera Kerala's descendant, and after improving it to a great extent, introduced therein his own caste people, to whom he ultimately committed its government.

It is very clear, that the Brahmins above alluded to, soon separated themselves into two grand divisions, one the worshippers of Varahom (the superstitious incarnation of the Boar) and the other, worshippers of Sharabhom (a peculiar huge bird). The former distinguished themselves by the name of Punneyoor Gramakar (Boar-villagers), and the latter by that of Chovoor Gramakar (Bird-villagers), and they endeavour by all possible means to retain these designations and distinctions up to the present day. These comprise the Numboori Brahmins of Malabar, as distinguished from the Brahmins of any other district. This division among the Malabar Brahmins is evident from the Copper Plate No. I, the Boar-villagers and the Bird-villagers are the principal witnesses therein.

But at the same time it may easily be gathered from the Scanda Poranoom and other works (after rejecting obvious fables) that the Brahmins who lived in the country between Canjarote Pooya

(River) and Gokurnom, soon detached themselves from the above two grand divisions, together with that part of the country, and instituted therein a separate government. This on their subsequent decay was eventually taken possession of by certain Rajahs of the adjacent eastern countries; but I will go no further at present on this subject as it relates to *Mangalore;* my object being now solely to explain the contents of the Copper Plates which refer only to the remaining part of the country now called Malayalom, or Malabar Proper.

This Malayalom country, from the southern boundary of Mangalore to Travancore inclusive, was then constituted a separate Government under the hands of those called the pure Boar-villagers and Bird-villagers, but unfortunately for them, they soon began to contend among themselves regarding the affairs of the Government, and this ultimately induced them to seek Peroomals (chief) from Chera or Salem, under a condition that each Peroomal should rule for 12 years only; moreover from fear of encroachment by the Peroomals, several of the Brahmins of the two grand divisions formed themselves into four principal and several other petty Talis (or associations with certain powers to check any unwarranted acts of the rulers of the country), under the Peroomals, retaining for this purpose in their own hands various executive and fiscal prerogatives. The four principal Talis were located at Cranganore (Codungalore), which place all the Peroomals with the members of those four Talis made their chief abode. These members were called Taliyadrimar. The Plate No. I. also makes mention of the said four Talis. Some of the places where the petty Talis were originally located still bear the affix "Tali" in addition to their proper names, such for instance as Calicut Tali, Chenengat Tali, Koote Coomnut Tali, Neeleesuwaruth Tali, &c. The names of the four principal Talis were Mettali, Keettali, Neediy Tali, and Chingapooruth Tali.

The power and influence of the Peroomals however, gradually increased, while those of the Talis has progressively decayed; during this period, the Peroomals had sons and daughters both legitimate and illegitimate by females belonging to the family of the original Veera Kerala as well as by those of other families—and some of

the sons thus descended were appointed by successive Peroomals in various places as petty chieftains governing, subject to themselves, the districts thus conferred on them; but without the title that is now assumed of *Rajah.* This latter fact is proved not only from the Copper Plate No. I, but also from the other two; for those plates merely mention the names of such chieftains as witnesses thereto without assigning to them any title which belongs to a Rajah.

The popular tradition of the present day, that all the present Rajahs of Malabar first derived their origin from the last of the Peroomals, and that that personage embraced the Mussulman faith has not the least foundation; though it must be here admitted that the title of "Rajah" was first given to most of the former chieftains by this Peroomal, with a view to gratify and encourage them to oppose Kistna Row, the Rajah of Anagoomty (situated on the banks of the Toombudra), who was then making preparations to invade Kerala. The numerical mottos which were then adopted with the view of fixing the date of the assumption of the title of Rajah, and which are still in existence, show the dates from which they thus had that title—for instance Raveeloke Sharajay, is the motto of the Cochin Rajah; Shulbhagastamsharajay, of the Palghaut Rajah; and Devalokesharajay, is the motto attached to the Calicut Rajah, the last preferred by the Peroomal to the dignity of Rajah, and who was selected to be the head of the warriors against the above Kristna Row. All these dates coincide with A. D. 325, there being a difference of only a few days between them. This last Peroomal was the only person who was permitted to evade the rule as to 12 years residence only in Malabar, and to remain in power more than 36 years in consideration of the services he had rendered to the Taliyadrimar, and for having defeated and driven out Kristna Row. This Peroomal afterwards resigned the country and proceeded to Mecca, called in Sanskrit Magadha, in or about A. D. 352, or 217 years previous to Mahomet, the founder of the Islam religion being born, and this departure was due chiefly to the religious inducements of Majains called Jainias or Boudhas, who as a people were then settled in Arabia, and many of whom visited Malabar. The original name of Mahajains became in time corrupted into Magains

or Magans. The Hindoos through mistake call the Mussulmans also Boudhas, and from that error they fell into this other, that the last Peroomal embraced the Mussulman faith, and the Mussulmans in former days taking advantage of this ignorance of the Hindoos, invented several fables about the Peroomals in honor of their own religion. It may thus be safely concluded that both the parties are now in error on this point. One Zeirroodeen Mokadom, an Egyptian Mussulman, who visited Malabar about the time of the Portuguese, admits this being an error, in the work he wrote in Arabic about Kerala.

The Peroomal first chosen having been a native of Cheram (now called Salem, and which comprised also Coimbatore) he was therefore called the "Cheraman Peroomal," and this affix was given to all the succeeding Peroomals who came from Cheram, till it eventually became a regular title. This fact may clearly be observed from the Copper Plate No. I, which calls the country Cheraman lokoun (Cheraman's country) long before the celebrated and acknowledged last Cheraman even made his appearance in Malabar.

There appears to be some mistakes in a few letters made by the engravers of these Copper Documents ; and when compared with the present improved system of the language, some inelegancies in the composition and style also are apparent ; but these have not the slightest material effect upon the real meaning of the contents. Here follow the Documents.

Copper Document No. I.

" Beginning from Sri Veera Kerala, the Earth Ruler, the Man-" lord, the Emperor, the Sceptre has been swayed through a regu-" lar succession of many hundred thousands of years, when Sri " Veera Raghava Chucravurti (the Emperor Veera Raghava) was " in possession of the country and was seated in the Royal Palace, " (the following grant was made) in the year when Jupiter was in " Capricornus, on the 21st of the month of Meenom, Saturday, " when [as it is further implied] Saturn was in Pisces and on the " day of Roham, the 4th Asterim.

" We have given Manigramom (the village called Mani) to " Iravi Corten (Curten) of the town of Mahadevor, the grand " Chettiar [Merchant] of the Cheraman's country. We have

" also given to him the right of Peelavata,[a] of having the Pavana-" tungum house Pillar[b] and of receiving Puroopcrooma[c] and " Kadatoo,[d] and further the honor of having Valinchiyem and Ta-" nichett in Valinchiyem,[e] and moreover of having the privileges " of Moora Cholloo and Moomata,[f] and Puncha Vaddium,[g] and " Changoo,[h] and Pakel Veluka,[j] and Pavata,[k] and Aymtolom, " and Cotta Coda,[m] and Vadooca Para,[n] and Idopati[o] and Tora-

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a. A cloth permitted to be worn over the shoulders by people of high caste alone.

b. A carved Pillar erected in the south-east corner of the portico, which, as also the portico were in former days forbidden to Sudras and other people of inferior caste.

c. All the revenue.

d. The fee paid by rich persons and merchants and particularly females, to the Ruler or chief of a district for a guard for their personal protection when travelling from one country to another, also ferry tolls generally.

e. The carved sword and sovereignty or authority with the sword.

f. Fore-runners and the recital of praises, the heralds proclaim the title and deeds of the person in the State vehicle, a practice still observed in the processions of the Zamorin, &c.

g. Five musical instruments of Malabar, viz., Jenta, Chengalam, Eelatalom, Muddalom and Koyel.

h. Conch which in former days was used only in the Pagodas, and before a Jogee or Sunnyasi.

j. The lamp by day, i. e. a brass lamp with a long tail or handle, a lamp of this kind is carried lighted in broad daylight the same as if it was night before the idol, when borne on the head of a Nambudry Brahmin in the daily Pradakshana or procession round the temple. It is also allowed to be carried lighted before Jogees and Sunnyasies even in the day time.

k. The cloth spread on the ground along the streets for the Raja to walk upon, when he proceeds with all pomp in public procession round the city on a fixed day after his accession to the throne.

l. A sort of litter permitted to be used only by Rajas or Brahmins.

m. Royal umbrella with a very long handle, which none but a Raja is permitted to use.

n. A drum, such as is used in the Northern Tamil and Teloogoo countries, and which is beaten before the palace of a Raja at the same time with the Puncha Vaddium, or five kinds of musical instruments, in the morning, at noon, and in the evening.

o. A carved plank to sit upon, which was forbidden to be used by eudras and other inferior castes, and was placed generally on the south-hrn, though now occasionally on the western. side of the portico of the Souse.

"nom,[p] and Tanichett,[q] over the four Cheries,[r] in the city of "Manigramom—moreover we have given him as slaves the oil "manufacturers and the Ainkoody Cummàlers.[s] We have given "to the Lord of the Town, Iravi Corten, the Taragoo[t] and Choom- "kom[u] of all that may be meted by the Para,[v] weighed by the "balance, or measured by the string, of all that may be counted "or carried, in a word, of all from salt to sugar, and from musk "to lamp oil,[w] within the Codungalore harbour and the town "between the four Talis and the gramoms (villages) adjoining "thereto.

"We have written and given this Copper Plate with water,[x] "&c. to Irawi Corten the Cheraman lokaperroom Chettian,[y] and "to his sons and son's sons, in regular succession.

"With the knowledge of the Panniyoor Gramom and Chovoor "Gramom[z] we have given it; with the knowledge of Venàdoo

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p. Furniture and decorations in the temporary erections on the occasion of a marriage, &c., permitted only to the higher castes.

q. Sovereignty or executive jurisdiction.

r. The four suburbs, streets or bazars assigned as usual to different castes or occupations.

s. The five sects or castes of Artificers, viz., the Ashàri, Mooshàri, Tattàn, Perning Collen, and Tol-Collen ; or Carpenter, Brazier, Goldsmith, Blacksmith, and Tanner. The term Cummalar signifies, mean or low, but the term is not applied to them from contempt of their profession, but because of the order assigned to them in the grand division of castes, in which they are ranked as Artificers. It may perhaps be surmised that the sense of contempt which this term now implies as "low" and "mean" was adopted by the people of Malabar in consequence of the five sects comprised under this designation being given to the degrading and shameful custom of marrying one girl among three or four brothers.

t. Brokerage.

u. Dues or customs.

v. A measure containing 10 dungalies, but really varying in different parts of Malabar, sometimes as for salt equivalent to the Indian maund.

w. These are familiar phrases and signify all and everything.

x. That is with water and flowers, for every fee simple or Janum is transferred with the ceremony of pouring water with some flowers strewed upon it into the hands of him who receives it.

y. Grand or chief merchant of the Cheraman country.

z. The two grand divisions of the Brahmins of Malabar before mentioned.

" and Onadoo,[a] have we given it; with the knowledge of Erna-" doo and Vulwanadoo,[b] have we given it; we have given it for " the time that the Sun and Moon shall endure. " With the " knowledge of the above has this been written and engraved by " the hand of Nambi Chadayen, Grand Goldsmith of the Chera-" man country."

According to the well known and absurd practice of Hindu authors, the above Copper Plate No. I as a preliminary states that the country had been ruled by the successors of Veera Kerala, the original Prince, for "*many hundred thousands of years*." It seems therefore quite unnecessary for me to make any comment on so vain and foolish a preface.

It is quite clear that this document was given by Veera Raghava Chucravurti in the year when Jupiter was in Capricornus, and Saturn in Pisces, and on Saturday, on the 21st of the month Mee-nour (March and April) and on the day governed by Rohani the 4th Asterism, therefore to find out the date of the document in question, it is imperative on us to undertake to ascertain when the above mentioned phænomena occurred during the administration of the Peroomals, or indeed at any other period, either antecedent or subsequent to it. If this task be patiently persevered in, we cannot fail to attain the object of our desire.

Previous to the institution of the Collom Era in Malabar (i. e. 1030 and odd years ago) by Shunkara Achàriar, it was usual to insert in documents either the number of the days elapsed of the present age called the Kali-yoogom, or else the Zodiacal sign in which Jupiter and Saturn then severally stood, adding thereto the month, date, and the day of the week, and the Asterism of the day. Moreover it should be borne in mind that in ancient times if in any year Saturn or Jupiter stood for more than one-third thereof in any one of the Zodiacal signs, it was usual to call the whole year after those signs, affixing the names of Saturn and Jupiter. Even after the Collom Era had commenced, and that year together with months and dates came into use, the former method also was occasionally

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a. The deputy chieftains of those two districts.

b. Deputy chieftains of those two districts now known as the Ernaad and Vulvanad Talooks of Malabar Proper.

used, and though this practice was ultimately dropped, and the year, month, and date alone appear now in deeds, yet in some of the astronomical writings, &c., the ancient practice is still employed up to the present day.

Now, therefore, to find out the date of the Plate No. I, it must be ascertained from the best astronomical calculations, on what particular day the above state of the heavens actually occurred, and to prevent any mistakes creeping in, it behoves us to make the computation upward from the present date. Accordingly by repeated trials I have come to this final conclusion, that such a concurrence of the heavenly bodies happened on the 1,216,665th day or in the year 3,331 of the Kaliyoogom. Though it may be objected that Jupiter left Capricornus 5 days and 16 astronomical hours previous to the day in question (that is the date of the deed No. I.) after remaining fully 11 months and 25 days in it during that year, yet in accordance with the practice above stated, the year would be correctly described as that in which Jupiter was in Capricornus.

Now for the present Collom year 1031 or A. D. 1855-56, the year of the Kaliage is 4957 from which if we deduct the above-mentioned 3,331, the remainder will be 1,626 corresponding with A. D. 230; which is therefore unquestionably the date of the Copper Plate No. I.

To make this plainer to Astronomers, I subjoin the following Memoranda.

On the 1,216,665th day of the Kali-yoogom, or age, the Sun stands thus............11
20
37—find the month and date by this.

The Moon stands thus..01
18
28—find the Asterism by this.

Jupiter stands thus.....10
05
16—find by this the Zodiacal sign in which Jupiter stood in that year.

Saturn stands thus.....11
24

41—find by this, in what Zodiacal sign Saturn stood on that day.

If the above mentioned 1,216,665 be divided by 7, the remainder will give the day of the week. For, according to the acknowledged Astronomical authorities, Friday is the first day of the beginning of Kali-yoogom or age, so that the divisor 7 should be reckoned from Friday to Thursday, and 2 being the remainder fixes the day of the week as Saturday.

The Nassaram (Nazarene), the chief Merchant who received this Copper document No. I. is styled "Iravi Cortam"—"Iravi" in Tamil or "Ravi" in Sanskrit means the "Sun"—Curten (or Corten according to the corruption in Tamil) means "Lord" or "Chief," and when these two words are compounded they become "Iravi Corten," a mere title in which no shadow of a Syrian name is to be traced. This same word "Iravi" or "Ravi" likewise will be found to be prefixed to the title of some of the Rajahs of the present day as it was also to that of many of the Peroomals in former days.

This honorary title "Iravi Corten" was given to the man in question by the then ruling Peroomal, and the bare title only is mentioned in the document in accordance with the custom of persons of high rank, who always omit to state their personal names in such documents, &c.; a practice which is generally followed up to the present day. The Peroomal thus promoted him to the Lordship of the city with other privileges and honours, and *that city* appears to have been situated somewhere between the Codungalore harbour, the Gopoorom or Gatehouse of Codungalore, the 4 Talis, and the adjoining Gramoms or villages.

There is every reason to believe that the city Manigramom, which Iravi Corten of Mahadeva Patnom (i. e. Codunlagore so named because the Peroomals resided there) obtained by this Document No. I. as also Auchoo Vunuom which Joseph Roben, a Jew, obtained by Document No. III. were chiefly inhabited by Jews and Nazaraines (Syrian Christians) indiscriminately and not to any extent by Hindoos; for otherwise the Manigramakar, the inhabitants of Manigramom, as well as those of Anchoo Vunnom

unless they were Jewish and Christian principalities would never have been appointed as they were by Document No. II. to be the protectors or Trustees of the Tarisa Pully or Church erected by Isodata Veeray.

The city Manigramom above alluded to derived this name from the wealth it then possessed and not as the Nazaraines think from other reasons. Thus for example the Muckwas (or boatmen) in their songs m ke mention of Nalla Maninagaram or "Great city Mani of Maday in the Cavage Talook, whereas there never has been, nor is, any city of that particular name at Maday. Again, the best of any 10 things is called Mani (i. e. Principal or Chief) and if the Manigramom of the documents in question had not had that title given it merely on account of its then great wealth and superiority, it would have existed still under the same name as is the case with many other old cities. Further, there is no probability attached to their assertion grounded on their own tradition which alleges that the name of Manigramakar (inhabitants of Manigramom) was derived from one Manica Vachaker (a Tamil Poet) for if the name had its origin from any such person it would have been Manica Vacchakennar and not Manigramakar.

The tradition on this point is that many of the Nazaraines having followed a certain heathen Conjuror named Manica Vachaker and been thus drawn into error, they ever afterwards had the name of Manigramakar, but that the rest who proved steadfast to their faith received the name of Dhuariakel or Dhairishalikel, that is men of courage. From this tradition there may perhaps, if any thing at all, be inferred that about the time when their city from its wealth and importance had the title of Mani, many of the Nazaraines thereof in some way or other became Schismatics, while a few only adhered with courage (Dhairya) to their faith.

The Document No. I. calls Iravi Corten a Chettian; the weaver as well as the oilmonger, is now as also formerly called Chettian; so that it is very probable that when Iravi Corten first came to Kerala his trade was either in cloth or oil.

It must not be inferred from the fact that the Kollatry or Chemkal Rajah is not named as a witness to the Documents No. I. or No. III. along with other chieftains, that he was not then under the

control of the Peroomals, for he was certainly promoted by the predecessor of the last Peroomal from his deputyship to be the Rajah of Cherukal in A. D. 307, the numerical motto of his title being Neeradhisamaraya—the reason was no doubt that he was located at so great a distance from Codungalore.

Because the Copper Document No. I. says that Veera Kerala is the first prince of Keerala, there is no just ground whatever to suppose therefore that he was the first of the Peroomals, for, such works as the Kerala Pooranom and others, though no doubt full of fables, yet coincide in stating that Veera Kerala was the first prince who governed the country before Parasoo Rama had conquered, and then transferred it into the hands of the Brahmins; while the various copies of the Keralolputty concur that Keya was the first of the Peroomals, and from this and many other circumstances I believe that Veera Kerala and Keya were different persons.

Again, there is no ground to suppose that the Cochin Rajah is descended from the said Veera Kerala, for, from various authors, it is clear that the Cochin Rajah is descended from Mada Peroomal, one of the predecessors of the last Peroomal, and, therefore, even up to this day the Cochin Rajahs are called Mada Bhoopatis or Mada Rajahs.

Document No. III.

" The sceptre has been swayed for many hundred thousands of " years, of which in this the thirty-sixth year over against the " two, Sri Bhaskaren Iravi Vurmen, the Royal born personage, " the Co [the Raja] living in Mooyeericode was pleased to be- " stow this deed of gratification to Joseph Roben.

" Thereby is granted to him Anchoo Vunnum, (i. e. 5 small " villages) together with the privileges of receiving for himself the " Petti[a] and of receiving Vayonam[b] (or Vainom) and of having " Pacootom[c] and of receiving Anchoo Vunaper[d] and also of hav-

a. Revenue derivable from different ferry boats and vessels called Petti and Padacoo.

b. A tax on horses, &c.

c. The right of taking every six months a handful of all the medical ingredients exposed for sale in bazaars.

d. Every branch of revenue derivable from Anchoo Vunnom.

" ing [the undermentioned privileges explained already in the " document No. I. viz.] the Lamp by day, the spreading of cloth, " the Litter, the Royal umbrella, the drum of the Vadooca caste, " the trumpet-shell, the carved plank to sit upon, furniture in the " wedding room, and [peculiar decorations on the same furniture " called] Tooranaveedanum, Charavoo and Mickoo.[e] Moreover, " Oolakoo and Toolacooly,[f] are hereby relinquished to him [i. e. " to be appropriated for his benefit] he has not to pay the Aroo[g] to " the Royal Palace, but on the contrary it should be given by the " Ryots of the village to him; in a word, the 72 Veedooper[h] are " hereby by this Copper document granted to him.

" Thus it is hereditarily given to Joseph Roben, the Lord of " Anchoo Vunnom, his heirs, his sons and daughters, his nephews " and nieces, and his sons-in-law, and as long as the earth and " moon exist, Anchoo Vunnom is hereditarily given to him.

The witnesses are

" Govurthana Martanden of Venadoo Kotai, Cherookunden of " Venoovalinadoo, Manavepala Manaveyan of Erralanadoo, Irayen " Chatten of Vulwanadoo, Kotai Ravi of Neetoompoorayoorna- " doo.

Also are

" Moorken Chatten and Vuntalacherri Kanden, the subordinate " heads of the warriors.

" With the knowledge of these, this was written by Keeyoovay " Kelluppan of Coonnapooya."

To fix the date of this Copper document No. III. granted by one of the Peroomals and now in the possession of the Jews, a search should be made into the following phrase therein, viz. " Irrundamandek Etir Moopputtaranandoo" that is, the 36th year over against two centuries, meaning the 236th year since the Government of Peroomals, first began; but such a search can never be available without first correctly ascertaining when such Govern-

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e. A kind of bow and arrows carried in the hands of the forerunners.

f. That is Choomkom and Taragoo or the usual customs and brokerage.

g. The fee for bonds executed.

h. The 72 similar privileges.

ment really began. That such Government began about 68 years before the beginning of the Christian era, has been already stated in a preceding page of this paper. So that it is clear that this document was executed in A. D. 168 or 62 years previous to the document No. I.

The Hindoos as well as the Europeans appear up to this day to have failed in finding out the correct dates of these documents, because the former without discretion or judgment are always apt to accept as true the *most* remote dates, which their writers without any bounds or limits have introduced into their writings, just as may happen to suit the measure or the rhyme of their poetical legends, upon subjects they are quite ignorant of. Thus their calculations extend to unlimited periods beyond all chance of reality. On the other hand the views of the Europeans generally fall short of the real facts, because they have not yet been able fully to comprehend when Kerala first began to be civilized, and also because they find that the civilization of its people has not yet arrived at that perfection which it otherwise should have.

It is no doubt an important question for decision, how it is that if Kerala were so early civilized and possessed of rulers and subjects as well as laws and regulations, they not only never appear to have acquired any other country, but have besides lost their own that they had? To this I answer, it is true that they both formerly had and still have in their possession some books such as Kamnutikeeyom, &c., which treat of different branches of military arts, &c., though these will by no means vie with the present military skill of the Europeans ; but it must be concluded that their blind superstitions entirely barred their progress in other countries, for they believe that they cannot live amongst others without pollution and the violation of their numberless castes, and the privileges appertaining thereto. It is from such foolish notions that they as well as the other Hindoos of Hindostan became like birds in a cage, precluded from passing into other countries, and acquiring them and of embellishing their own country with the fruit of the sciences and learning of other kingdoms. Again, it is not a matter for surprise that a ruling sovereign should lose his own country by exhausting his treasury

in meeting vain and frivolous expenses for comedians, songsters, nautch-girls, jesters and such like, and so leaving no means either to maintain an efficient army for the protection of the country, or to secure the services of good and wise and good ministers. Moreover, power and dominion are not of man, and whosoever therefore converts that power into an instrument of sensuality and injustice, it is a certain truth will be deprived alike of his power and kingdom.

Amongst the witnesses of this Document, Moorken Chatten and Vuntalacherri Kunden, are no more than the junior heads of the army which then existed, and Chatten is the man's own name, and Moorken is the name of either his father or uncle, or else his family or Turwad name. In like manner Kunden is the name of the other witness, and Vuntalacherri his Turwad or family name, &c. Further, as for the word Vuntalacherri, there is not the least ground to construe its meaning into "Great Tellicherry," a town in the possession of the Koletteeri or Cheruckel Rajah. Besides that personage received that territory and title from one of the Peroomals only in A. D. 307 or 139 years after this Document had been executed.

Keeyooray Kelluppen of Coonnapooya, the engraver of this Copper Document, is no more than a goldsmith who resided in Coonnapooya, a spot situated on the way from Codungalore (Cranganore) to Cochin, and where there is a pagoda called Teroo Coonnapooya. It is true that there is a spot called Coonnapooya in the Cooroombranad Talook situated far distant from Codungalore; but it is therefore improbable that Kelluppen was a resident of that spot. The name Kelluppen is merely a common name amongst the Soodras and other castes below them, and Keeyoovay is nothing more than his family or Turwad name, and no other meaning can reasonably and correctly be attached to any of these words.

The personal name of one of the witnesses is not mentioned in this Document but only his Royal title, as was the usual practice formerly and it often is at present of the Malabar Rajahs. That Royal title is "Mana Vapala Mana Veeyen" of Eralanad, or now called Ernaad. Though this is omitted in the Document No. I., there is every probability that this personage received Eralanad

from one of the Peroomals before the date of this Document No. III., but at what particular date, has not yet been ascertained. But the Calicut Rajah obtained his little district from the last Peroomal in A. D. 325, and his immediate successor defeated Mana Vepala Mana Veeyan and took possession of the Ernaad country in or about A. D. 365, on which occasion the Calicut Rajah assumed this title changing it into " Mana Vullabha Mana Vicramen" (or the husband of honour, and husband of honorable power) and added the same to his own title, though both the titles bear exactly the same meaning. (For further details I must refer to the chapter on the Needeeyeeroopoo or Calicut Rajah in my unpublished work.)

Venoovalinad was afterwards ceded to Travancore and Neetoompoora Yoornad to Cochin, but it appears that the chieftains of those districts under the Peroomals, as well as the chieftain or Deputy of Vulwanaud had not at the date of this Document received from the Peromal the title of " Raja" as is proved by this Document from their bare names being inserted in it as witnesses without any Royal title whatever.

Though no other authentic documents are forthcoming to ascertain what particular spots are the Mooyeericode and Anchoo Vunnom of this Document No. III, yet from the Document No. II it may be gathered that Anchoo Vunnom must be somewhere near to the Manigramom of the Document No. I, and from other circumstances there is every reason to believe that Mooyeericode was a desham or small parish attached to Codungalore.

Document No. II.

This document was granted in the time of the last Peroomal to the Tarisa Pally or Church by the Travancore Raja together with Maroovan Sapir Iso transferring Anchoo Candi (*i. e.* 5 pieces of land) as a freehold with certain privileges to the Church People. This Document appears to elucidate several of the terms in the two others Nos. I. and III, and it further points out some of the old customs of Malabar. Though this Document appears to have some confusion in the arrangement of a few of its sentences and words, this does not affect the real meaning of its contents.

(1) " Hail! In this the 5th year of the reign of Peroomal

" Stanoo Ravi Goopta Co [King] comprised in the many hundred " thousands of years in which (his ancestors) ruled, having op- " posed and conquered their enemies, the Ayyen Adigul Teeroo- " vati [*i. e.* His Excellency the servant of Vishnoo, that is the " Travancore Raja] granted the following Deed of Vidooper [Pri- " vileges] to the Tarisa Church built by Isodata Veeray of Cura- " cani Collom, in the presence of the Adicarur (the Ministers) " Pracriti or Sumprati (the Officers) Anchoovunnom [*i. e.* the " inhabitants of Anchoovunnom the Jewish Principality] and " Poomatala Pati [or the Head man of the village of Poonnatala.]

(2) " The four houses (or branches) of Eeyover[a] and eight " houses of Eeyoovakayer[b] as well as the one house of Vun- " nan[c] coming from the same stock, are to pay (henceforth to the " Church) the fetter[d] tax, the ladder[e] tax, the elephant feed- " ing[f] tax, the cloth washing[g] tax, as well as the tax on gold " washing both from sands as also from streams and also the " Night-meal tax.[h] I (*i. e.* Maroowan Sapir Iso) who also be- " fore this held Anchoocundi by Varakole and Cawa,[i] have now " granted these (to the Church) on Vidooperak Atti (*i. e.* in ab- " solute fee simple tenure).

(3) " It has been arranged so that those four houses of " Eeyoover,[k] one branch of washerman, two branches of Neeroo-

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a. Servile caste of toddy drawers generally called Teeyer.

b. A similar caste but of much inferior degree, who could however marry into the families of the former.

c. A caste of washermen who can wash the clothes of such inferior castes only.

d. A tax upon the foot rope and hand rope used for climbing cocoa-nut and areca nut trees, &c.

e. A tax upon the bamboo ladder used to mount the trees in gathering pepper and other produce.

f. A tax upon the pay of the elephant keeper.

g. A tax on the said washerman's work.

h. The taxes paid upon different other duties performed by these castes, after which only they take their regular meals at night.

i. A stick and string, that is the ploughshare and the halter rope of a bullock which as a sign of real transfer are given into the hands of the receiver of the land.

k. These include the other eight inferior branches.

" diyar,[l] one branch of carpenter, together with four branches of " Vellaler [the Vellaler are Sudras with certain privileges] who in " particular are the Karaler,[m] of this land (Auchoocundi) should " for the sake of God plant that which may be planted and sow " what may be sowed in order that the oil and other articles re- " quisite, &c. for the Church, be not deficient.

(4.) " Thus regarding this land which Maroovan Sapir Iso " received with drops of water,[n] and which he (in like manner " now) gives with drops of water to the Tarisa Church (it has " been settled) with the concurrence of the Palace Major Vyraku- " laver[o] and in the presence of Ayyen Adigul Teeroowati (Travan- " core Rajah,) his Junior Rama Teeroovati, his minister and offi- " cers, and the 600, and also of the head men of Poounatala and " Poolacudi[p] that the boundaries thereof lie to the east Vayul- " cadoo,[q] to the south-east Cheroovàtil Kunmatil,[r] incuding the back " water, to the west of the sea; to the north the Torana garden; " and to the north-east Antillon garden of Poonatala. All the " land comprised within these four boundaries is hereby by this " Copper deed granted in possession to the Church for as long as " the earth, moon and sun exist.

" (5.) " And it has further been settled with the concurrence " (or in the presence) of His Excellency the Ayyen Adigul H. E. " Rama and the Palace Major, that for any offence whatsoever " which the inhabitants of this land commit (between themselves) " they are to seek for redress from the Pulliar (Church people) " alone. Head Price and Breast Price[s] shall belong to the Church

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l. Salt makers and fishers comprising the Vettoover and Mookaver or Mookwa castes derived from the same stock

m. Trustees.

n. The typical ceremony on the transfer of an estate in fee simple.

o. That is the inhabitants of Anchoocundy.

p. Neighbouring villages.

q. Open waste plain.

r. The wall near the little gate.

s. Revenues derived from the sale of males and females, for serious caste offences. A high caste man or woman having connection with an inferior caste woman or man contrary to caste prohibitions, they are severally turned out of the caste and used to be sold by the then ruling authorities, and even in the present day the Numboori Brahmins and other high caste women are for such offences in like manner often sold by their relations, chiefly to the Musselman Mapillas.

" people alone. Mine own relations whoever they may be shall " never have the right, as heads of the land dealing with the " subjects to pronounce judgment upon them. Let the 600, (i. e. " the local inhabitants) the Anchoovunnom and Manigramom (i. e. " the Jewish and Christian principalities) be the protectors of the " Church and the land, and act according to the manner detailed " in this Copper deed for the time that earth, moon and sun exist.

(6.) " The Palace Major Vyra Kerdever and H. E. the Ayyan " Adigul and H. E. Rama together granted the 72 privileges to " Anchoovunnom and Manigramom (i. e. the Jewish and Christian " principalities) to wit. That they are not to pay Oolakoo (i. e. " customs due to the Palace) viz., one per sixty for goods they " bring in and send out, they are not to pay (to the Palace) the " Alkashoo (personal cash) for slaves they buy, moreover they may " receive 8 cash for Vainom, (i. e. horses, waggons, &c.) in com- " ing in and going out; they may receive 4 cash for conveying in " or out on the Petti and Padacoo (two kinds of ferry boats)—the " customs due on goods (of others) should be received, and such " goods should be released in their presence and the estimating of " the value of (such) goods and the conducting of any other such " business which belongs to the Swamy (i. e. either the King or " God) should only be done in the presence of the (Palliar or " Church people.)

(7) " Such daily collections of Customs should be preserved " and kept (in deposit) by the Anchoovunnom and Manigramom " people.

(8) " The Copatavárom[u] on the sales and on Karaima[v] trans- " fers of lands lying within the four gates of this land, should be " received by the Palace but Patifátavárom,[w] should be received " by the Anchoovunnom and Manigramom people. The 72 privi- " leges such as the having the Bridegroom (Manavalen) mounted

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u. The king's tithe of 10 per cent.

v. A species of land tenure in Malabar giving an estate in perpetuity or for life, or till any condition or service, for which it is thus given, ceases.

w. Lord's or head man's tithe.

" upon an elephant with Manna and Neer[x] are also accorded to " them. Thus this Copper Deed is granted in the presence (or " with the concurrence) of Viracoo Dever the Palace-major H. E. " the Apyen Adigul, H. E. Rama, the Ministers and Officers, the " 600 (Local Inhabitants), and the heads of Poonnatala and " Poolacudi, so that it may be executed as is contained therein " for as long as the Earth, Moon and Sun exist.

(9) " If any injustice be done to Anchoovunnom and Mani- " gramom, they may withhold the Oolacoo and Toolacooli[y] as an " amendment for the injury done to them; but if there be any " crime committed among themselves, they are to investigate and " dispose thereof.

(10) " That which is done in unison by the two Chieftains of " Anchoovunnom and Manigramom who have taken the water " (*i. e.* received possession or livery of seisin) as Trustees of this " town will only be valid. Let Mooroovan Sapir Iso who took " the water for this town, called Anchoocundi, having now given " it up to the Church together with stick (and string), pay a full " compensation to that Church to which it formerly belonged. " This also I have given over by unrestricted transfer. I have " granted by this Copper Deed to Tarisa Church by way of privi- " lege and unrestricted tenure the Ira, or the feeding tax of every " kind for the time that the Earth, Moon and Sun do exist.

(11) " The Eeyoover (Toddy drawers, &c.) are permitted to " come together with their working instruments and follow their " occupations in the bazaar and within the wall. The Vannan " (the inferior washerman) may come and do his work in the " bazaar and within the wall. The leader of Teeyen (or Eerjoo- " ven) and the Captain (or Officer) of the wall or any other per- " son whoever it may be, has no power to molest them on the " pretext of any charges whatever, but should they commit any " offence the Pulliar (Church people) alone are to try them.

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x. *Manna*, a kind of seat or howdah and, *neer*, a kind of water pot, alluding to the right of thus carrying the bridegroom through the street on the marriage day.

y. Customs and brokerage which they as above are directed to receive and keep.

(12) " I have given this in the manner detailed in this Copper " Deed for the time that Earth, Moon and Sun do last, under the " terms of Vidooper (72 privileges) and Uttiper (unrestricted tenure.)

(13) " The person who has granted this Vidooper and Uttiper " to the Tarisa Church through H. E. the Ayyen Adigul is Moo- " roovan Sapir Iso.

(14) " May God bless those who keep this and are careful to " see it observed.

Written by Ayyen

" To him who is equal to the beautiful—that enlightens the " world—be victory."

To ascertain the date of this Document the following circumstances must be considered, viz., that Ayyen Adigul, the Travancore chief had not attained the title " Rajah" on the dates of the Documents Nos. I. and III. This fact as has already been explained is obvious from the Documents themselves; though he for certain had it previous to the date of this Document No. II. for it, in contrast to the other deeds, mentions his Royal appellation styling him " His Excellency (Terruati) the Ayyen Adigul." And next the last Peroomal as is already proved was 36 years in Malabar, and left it in A. D. 352, and this personage as is certain from different old histories was the one who promoted the younger brother of the Kolletiri, (or Cheruckel Rajah) to the dignity of the " Rajah" of Travancore.

So that if we deduct the 36 years from the above 352, the remainder will be 316, and it is thus clear that the last Peroomal began to rule the country in A. D. 316, and as this document was executed in the 5th year of his reign, if we add 5 to 316 it will give 321. It is thus plain that this document was executed in A. D. 321; and also that Venad Adigul or Travancore Rajah received the title of " Rajah" from the Peroomal some time between A. D. 316 and 321.

It may also safely be asserted that this last Peroomal was certainly a person of either the Vaisya or Soodra caste, sent as usual by the Salem sovereigns, who however it appears often sent Peroomal of the Chatrya caste also. For the name of the last Peroo-

mal was Stanoo Ravigoopten. Now when a Vaisya or Soodra rises to the dignity of Royalty, "Goopten" is properly always added to his name just as Sharmen is to that of a Brahmin and Varmen to that of a Chettrya; though in these modern days, some of the Soodra Rajas assume to add to their names the word "Varmen" contrary to the established customs of former days. There does not though appear to be any peculiar meaning attached to the words Sharmen, Varnen, and Goopten; but their sole use is for the purpose of honorary distinction between the castes.

When a deed of Attiper (i. e. an Estate in absolute fee-simple) is executed, it should, according to the custom of the country, be with the knowledge of neighbours and heads of the villages*—and the concurrence of the next heir of the granter in the presence of, or before, the Palace of the then ruling sovereign. Though in the present day such documents are not executed in the presence of the local authorities, yet it is almost invariable still to retain the old phraseology that the deed was "executed before the ruling Sovereign's palace."

The Eeyoover or Teeyer (toddy drawers) are a section of the servile class of people who during the time of the Brahmins and Peroomals came to Malabar from Ceylon to earn their livelihood. It cannot however be accounted for, how they, in many parts, though not throughout the whole of Malabar, come to adopt the beastly custom of the Kummalers of the country of a single girl being married to 3 and 4 brothers; and likewise in some parts of the country, where this sad custom is not so generally prevalent amongst them, the practice of taking their deceased's brother's widows for wives as the Mussulman Mapillas do. It is only in the Talooks of Needoonganad, Coottanad, Chowghaut, and some parts of Vettutnad and a few adjoining spots in South Malabar alone, that a woman among the Nairs is kept at the same time by 2 or 3 different men, who are though never brothers. It is though very possible that the Teeyers may have taken the idea from this latter error and themselves fallen into the other and more shameful one, or perhaps they observe the custom as they in general are,

* *Ayal-umpatigum Ayal* vicinity, neighbourhood. *Pati*-chie, head lord.

as this document in the beginning shows, sprung from Kummalers or the Kummalers from them, through their then frequent inter-marriages. This document No. II. calls them also Eeyoovahaiyer, a word equally low and contemptuous in Malabar and of the same meaning as the word Kummaler.

Moreover, amongst the Nairs of the whole of North Malabar, (that is to say from part of Cooroombranad as far as Mangalore) though sometimes unchaste practices occur in their families; yet, I can most confidently assert, that the above abominable custom of one woman being kept by two or three men at the same time, never in ancient or modern time was once known. A Nair there will, though occasionally, marry two or three women in succession: if the first or second prove barren, or, all the children born, die, or from any other like cause or domestic difference. Many of the Teeyers also of that part of the country do in some measure follow the custom of the Nairs; but the Teyettees (Teeyer women) of the remaining Teeyers there are notorious harlots and become the concubines of strangers of any caste or religion, and this without the least prejudice to their own caste, or any loss of esteem in society; on the other hand any such act proved against any females of the other castes, subjects the person to excommunication from caste, banishment from society, and all religious advantages. The Teeyer females of South Malabar do not, though so readily as those of the North yield themselves to this disgraceful practice. Owing to the very great number of castes, and the peculiar and different manners and customs in various parts of the country, the superficial enquiries of most foreigners have led them into error and in their works they generally ascribe the same pernicious practices to all castes and parts of the country indiscriminately.

However, the Nairs, Teeyers and indeed all the other numerous castes of Malabar (including the Cochin and Travancore countries, these being indeed the most striking in this respect) are in some way or other in a greater or less degree of error; and reformation therefore is indeed much needed among them all. It is though very lamentable to find them dormant in their original state of depression and not seeking for reformation rather than growing

blindly proud of their vain and different castes and privileges, and ready to run any risk even that of hazarding their lives, only to preserve their castes.

The Jews and Nazaranies or Syrian Christians must of course have come into Malabar a little before the dates of the Documents No. III. and No. I. Of the latter people, including the pure Syrians, and Roman Syrians, there are at present 1,81,009 souls in Travancore inclusive of males, females and children, though in A. D. 1836 there were only 1,74,566, and in Cochin there are at present 44,574 souls, making a grand total of 2,25,583 souls. The Jews, though they came here previous to the Nazaranies, are at present only 114 souls in Travancore, and 1,277 in Cochin.

Neither the Nazaranies nor the Jews ever made their abode north of Cochin, though there are a few of the former at Chowghaut (adjacent to Cochin) in the Zillah of Malabar. However, with the exception of their religion, the Nazaranies have in every other respect become like other natives of Malabar; their food, raiment, (that of the women alone excepted) language, manners and a few other customs, are similar to those of the Hindoos. Very few of them only study the Syrian language. The Jews also in many respects are on the same footing, though they yet preserve their Mosaic religion. There are a few black Jews also amongst them, and they as well as the Nazaranies in general are country-born. There are many wealthy persons amongst them, they have also lands and gardens like others, and also follow various trades in the country; they have also their Churches and worship. The Priest of the Syrians usually comes from Syria.

To my fellow-countrymen I must now candidly confess, that in explaining the above Copper Documents to make them more plain and intelligible, I have felt it incumbent on me to make a few slight remarks upon some of our Pooranoms, our superstitions, castes, privileges, manners and customs, &c., trusting that no offence will be taken thereat; for, indeed, I have done so partly for their own good to induce them to open their eyes and see our infirmities. It is indeed the earnest and heartfelt prayer of the writer of this paper, that they may be humble and set themselves to reform, and so growing wise and enlightened

become a people acceptable both in this and the other world, and so be happy for evermore.

The Rev. H. Gundert, a very distinguished and able gentleman, for whom I would express my highest respect, published a version of the above documents from old Vutteyoot, into the Tamil characters: this valuable paper I own has proved a great help to me in my delineation of those documents, and I shall feel that I owe it in part to him, should my present labours meet with any approval.

VI. *Memorandum on the Geology of Thayet Myo.* By J. L. Ranking, Esq., *Surgeon, Madras Army.*

[The following Memorandum was kindly placed at our disposal to accompany a box of specimens on Limestone from Thayet Myo (or Thayetmiew) an important military station on the right bank of the Irrawaddy. Remembering to have seen Limestone brought from this place while in Burmah in 1853, we were anxious to procure specimens of it for the Central Museum and Exhibition at Madras, and having acquainted Capt. Longcroft, 16th M. N. I. Brigade Major at Thayet Myo, with our wish, he kindly forwarded the required specimens with this Memorandum by Dr. Ranking.—Ed. L. S. J.]

The Geological features of the immediate neighbourhood of Thayet Myo have been described by Professor Oldham, and his report has been published in the 10th Number of Selections from the Records of the Government of India, to which I have not had access.

A slight reference to the subject is also made by the same gentleman, in a Geological Appendix to the narrative of a mission to the Court of Ava, by Captain Yule of the Bengal Engineers.

Mr. Oldham describes the hills near this station as "throughout composed of sandstones and shaly beds." In another part of the same report he gives a resumé of the Geology of the river valley, and writes that, "from the first appearance of the rocks above the Delta of the river up to Kyoukláloung, not far from the

old capital of Ava, nothing but tertiary rocks appear in the river valley, the main or prevalent *strike* of which corresponds with the direction of the river valley, that existing upon the broken edge of these beds is another series of sandstones and conglomerates, principally sandy, a few calcareous, though without any true limestone. Fossil bones are found in some of these beds, which (the beds) form the flatter expansions between and amongst the ranges and hills of the older tertiaries and the plateaus on their low summits.

The Geological age of the older rocks is said to be pretty well established as being of the Eocene period, the age of the more recent group is not determined, but supposed to be identical with that of the Sriwalik group of India.

The corresponding epoch amongst European strata is not determined.

Metamorphic and Crystalline rocks begin to appear near Ava."

Such is Mr. Oldham's opinion, and which I have expressed often indeed almost entirely in his own words.

He does not appear to have extended his researches into the interior of the country—his observations apply entirely to the immediate vicinity of the river.

My own limited observations in this neighbourhood, made with an almost equally limited knowledge of the subject, have fully enabled me to verify Mr. Oldham's observations to a certain extent.

The valley in which Thayet Myo is situated comprises an undulating plateau about 160 (?) feet above the sea, and from 40 to 80 above the lowest level of the river, rising to the southward and westward into low ranges of rolling hills, backed by higher and more broken and precipitous ridges; the undulating plains are composed of clays and river sands, with gravel composed of small rolled quartzose pebbles. Many of the lowest hills are, apparently, entirely alluvial; and in the next higher series (especially to the southward) sandstones occur, many abounding in marine shells. The highest hills to the southward furnish a compact limestone with shales and a vein of coal, which I have not yet visited, but which was inspected by Professor Oldham. Specimens of the shelly rock and of the limestone, are amongst those forwarded, and are labelled respectively v. vi. and vii.

The two former are doubtless of recent origin. I am not so sure that No. vii is.

Mr. Oldham, as before remarked, would refer it to the older tertiary formation. I am not competent to give an opinion. It is full (it will be observed) of small organic remains, the nature of which I have failed to determine, but which, though *smaller*, appear to be *identical* with those in specimen No. ii,* and which appear in oval or elongated bodies of tubular structure radiating from a central line thus a cross section presents the following appearances viz. tubes radiating from a common centre. I will not speculate upon their nature, but confess my ignorance and request information, and also as to the probable position the rock holds in the geological series. With the exception of these rocks, I possess none referable to the immediate neighbourhood, sandstones and marly beds also occur, and the general dip appears to be about 30° south south-east with a strike nearly north and south.

Having lately visited the Military posts of Yamuth and Mengdoon, the former about 28 miles due west, the latter 45 miles west, I may remark that the only rocks met with, from which the general dip and strike could be determined, and specimens procured, were found to consist of limestones and sandstones, shales and seams of coal. No. 1 specimen is a limestone found in a thick bed, with a strike nearly N. and S. and dipping 30° S. S. E. near Alay-gyoing. It contains organic remains of the same (naked-Moluscus ?) character (see particularly the polished surface of No. 1), and is a compact variegated marble.

A few miles (2 or 3) beyond the locality of this limestone; sandstones were met with (specimens 2 and 3) cropping out in the bed of a nullah and dipping at an angle of 40° and 45°, with a strike nearly due north and south. These beds contained no organic remains, but appeared of great thickness. No further rocks appeared till we reached Mengdoon—6 and 7 are specimens of the rock exposed upon the river's bank at that station.

8, 9, 10, 11, and 12, are specimens of the rocks associated with the bands of coal found beyond *Youbalay* (about 2 miles N. W. of

* Found near Mengdoon.

it), and which coal, being the immediate object of the journey, I may make a few remarks about.

Two veins were found within 2 miles of each other, but as no survey was made of the locality, I cannot say whether they were separate beds, or portions of the same vein—each was found near the water shed of a low range of hills, in a ravine, and consisted of two thin bands of coal associated with sandstones and shale. The *two* bands of coal were, in *one* vein 2 feet thick, in the *other* 3½ feet; in both the coal and its associated shaly beds dipped at an almost vertical angle; the *strike* of both was nearly north and south.

The coal itself is friable, easily frangible and not to be obtained in any large blocks. It burns with a good flame but much smoke, leaving a large ash, but it has been pronounced good fuel by the officers in command of the Government Steamers.

I do not give any positive opinion as to the workable quality of the vein, the almost vertical angle at which it is found renders it doubtful whether it would be remunerative.

A large nullah runs in the immediate vicinity, which is navigable for rafts during the rains; the locality is very feverish, and it is doubtful whether the European or Native of India could reside there, except for 2 or 3 of the most healthy months of the year.

The vein ought not to be lost sight of, and deserves the inspection of some competent practical miner and geologist.

I could find no fossil plants in the shales, and none in the sandstones; but some rolled pieces of limestone with organic remains, found in the neighbourhood (specimens Nos. i. ii. and iii.), are forwarded.

The limestone found in the hills to the southward is extensively quarried, and furnishes the "chunam" used at this station.

It is, after being quarried at the top of the hill, thrown over the hill side and carted away, from the bottom to the kilns which are at a village about equi-distant between this and the hills, viz. 2½ miles.

The kilns are of the ordinary Native construction, and seem to answer their purpose well.

The stone seems to be well calcined, and makes excellent cement, but possesses no hydraulic properties.

The cost at the kilns is	8	Rupees	per 100	baskets.*
Carriage from kilns	4	,,	,,	,,
Or if delivered here	12	,,	,,	,,

VII. *Alterations in the paper on the Genus Impatiens.* By Lieut. R. H. BEDDOME, *Madras Army.*

In the Descriptions of New Species.

The description of "Impatiens tenuis" to be omitted.

In the Plates.

The figure of "Impatiens tenuis" to be omitted.

In the Synopsis.

Instead of the latter 14 lines i. e. from the words "LEAVES RADICAL—Inflorescence a scape" insert following.

Leaves radical Inflorescence a scape.

Lower of compound petals 2 lobed.

Spur very long curved.

Spur twice the length of petals, petals smooth.............*I. rivalis*.....Anamallay hills (3000 feet) Courtallum.........

Spur longer than petals, petals with warts on inner surface..*I. verrucosa*..Anamallay hills 6 to 7000 feet.

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* Three baskets equal to one maund. The country between these lime quarries and Thayet is thick jungle, but at all times of the year a cart road is open. These hills are to the S. W. of, and easily discernible from, the Cantonment. A narrow ridge runs along the top. Both the Pegu and Arracan sides are covered with dense jungle. The kilns are quite within a morning's ride, and from their proximity of increasing value, now that the redoubt is being erected at Thayet, and Magazines, Commissariat Storehouses, &c. &c. are being puckah built.

Spur short.

Spur the length of lower sepal.

Leaves glabrous cordate, lobes overlapping	*I. scapiflora*	Neilgherries 7 to 8000 feet.
Leaves hairy above, cordate, lobes distant	*I. modesta*	Neilgherries, Sheavagherries, Anamallay 5 to 7000 feet.

Spur much shorter than lower sepal.

Upper sepals crenated	*I. crenata*	Anamallay hills 5000 feet.
Upper sepals not crenated, spur, a small knob at the back of sepal	*I. Akka*	Anamallay hills 7 to 8000 feet.

Lower of compound petals entire.

Spur long, incurved, twice the length of petals	*I. gracilis*	Anamallay hills 5000 feet.

VIII. *Notes on various subjects.* By Lieut. H. P. HAWKES, *Sub Assistant Commissary General.*

No. 3. *Ornithology.—On a method of constructing a portable aviary.*

To those who are fond of observing the habits and instincts of birds, a portable aviary is a great desideratum. Birds shut up in cages a few inches square are neither as healthy, nor as interesting as when their abode can be made to assimilate more nearly to their haunts in a state of nature. The aviary, the construction of which I am now about to describe, has at one time contained as many as 64 inmates of various species, all of which kept in full health and feather. Its first inhabitant is still alive having occu-

pied it upwards of seven years. A glance at the annexed figures will make the following description easily understood.

The floor of the aviary is composed of a platform of dealwood, 5 feet 4 in. long by 2 feet 6 in. broad strengthened by three cross battens, this is surrounded by an upright ledge, three inches deep, which in short converts it into a shallow box. To the inner *sides* of this upright ledge, the four sides of the aviary (which are made in *separate* pieces) are screwed.

The front and back parts of the aviary are of ordinary wire work, as are also the side pieces which are furnished with doors—the top, which also forms the cover of the box when packed, is of very thin dealwood. These being all prepared, it only remains to screw each of the four separate sides into their respective places inside the ledge of the platform, and to screw down the top over all when the aviary is complete. When packed, the four sides are placed *within* the ledge of the platform, or in other words, inside the box, and the cover screwed over all, it thus takes up no more room than an ordinary camp table. The whole is supported on folding legs. In lieu of perches I usually substitute two dwarf shrubs in pots nicely trimmed, as giving the aviary a more natural and pleasing appearance, a stock of ten or twelve of these shrubs should be kept to admit of their being occasionally changed. The floor of the aviary is covered with a tray of sheet iron, over which is spread fine sand.

No. 4. *Ornithology.—To make a self-feeding apparatus for an aviary.*

Although it is scarcely to be wished that those should establish an aviary, who from press of work or other causes are likely to be obliged to delegate the duty of feeding the inmates to their servants, yet still occasions will happen when it is inconvenient if not impossible to attend personally to the wants of our feathered pets, and it is to prevent the possibility of their suffering from neglect at such seasons, that I have contrived the following plan for a self-feeding trough which I have found to answer admirably. With troughs of this sort, for both grain and water, a cagefull of birds may, if necessary, be left for weeks without the slightest chance of harm.

The grain trough which is made on the principle of the manger is shown in elevation and section at figs. 2 and 3. The lid "a" opens with a hinge; "b" is the reservoir for seeds, "c, c, c" are holes for feeding, and "d" is the perch. Fig. 4 is a grain trough of the same sort, but round in form.

The water trough is merely a modification of the "fountains used in England," and constructed of materials most available in India. It is shown at fig. 5, and consists of a decanter, bottle or carboy filled with water and supported over a finger glass or suitable vessel by a slight framing.

IX. *Coin and Currency in Ancient and Modern times.* By Henry King, A. B., M. B., *Assistant Surgeon, Madras Army.*

"Empirici, farmicæ more, congerunt tantùm et utuntur: rationales, aranearum more, telas et se conficiunt: apis vero ratio media est, quæ materiam et floribus narti et agri elicit, sed tamen eam propriâ facultate vertit et digerit."—*Bacon, Aph.* xcv.

Two subjects are exciting considerable attention in the commercial world at the present time, decimal coinage, and the drain of silver from Europe to Asia. These may impart to the facts collected in this paper some of the interest which attaches to themselves. I have brought together, and arranged as systematically as my ability permitted, as much information upon Coin and Currency, in ancient and modern times, as my own very limited library, to which alone I had access, could supply. All are familiar with Lord Bacon's celebrated illustration which heads this paper. I have tried to imitate the Bee: I have, at any rate, followed the example of the Ant.

The subjects which I have endeavoured to illustrate in this paper are; the material of coin, the mint, systems of division, depreciations, and the eastward drain of the precious metals. Any mention of paper currencies has been impossible. To treat of them even briefly would require an exclusive Essay.

The first step in civilization is the division of labor; the second, the establishment of a circulating medium—of money in some

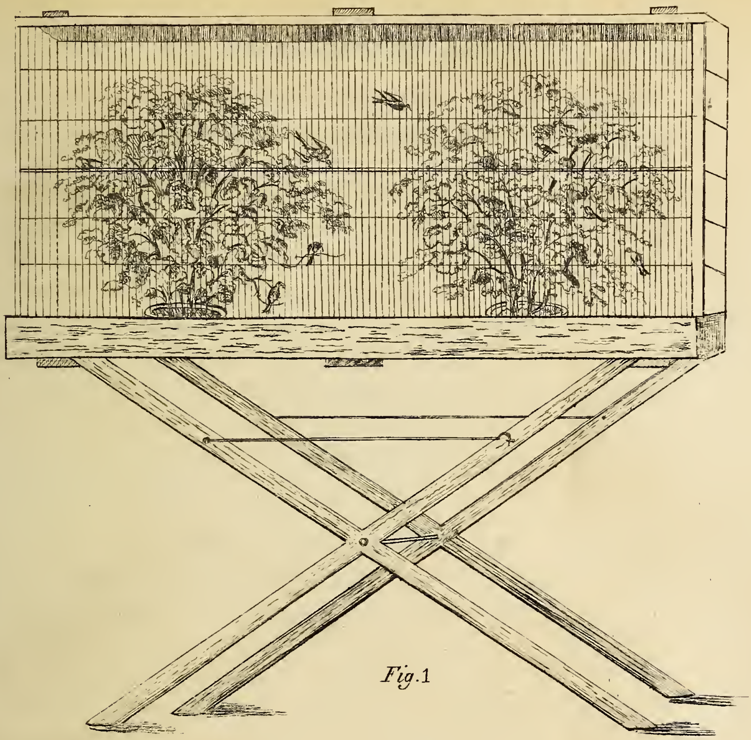

Fig. 1

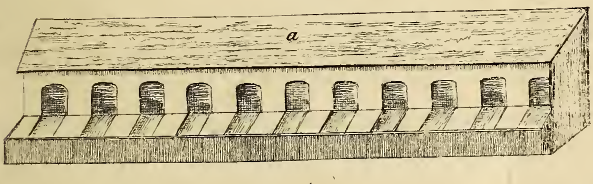

Fig. 2

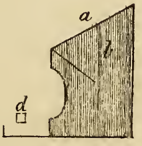

Fig. 3.

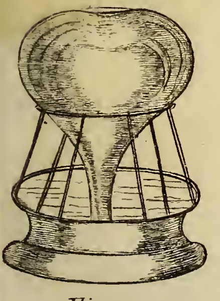

Fig. 5.

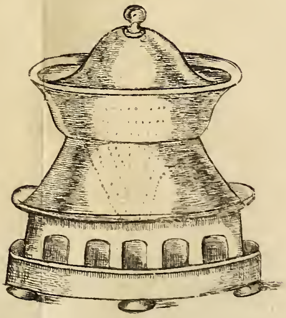

Fig. 4

BRITISH MUSEUM
NATURAL HISTORY.

form or other. When a people is once sufficiently elevated above the level of primitive barbarism to perceive the disadvantage of every man's being his own mason, carpenter and tailor—to feel and duly appreciate the increase in both the quantity and the quality of conveniences and comforts, consequent on the division of labour—it cannot fail, soon afterwards or even perhaps simultaneously, to be conscious of the want of a circulating medium; that is, some commodity of value either intrinsic or conventional, obtainable in sufficient quantities for effecting all the exchanges to be transacted, sufficiently divisible for the convenience of all classes of traders, and sufficiently durable to admit of being stored up when not required for immediate use. Such are the principal essential attributes of "money."

In a rude and early state of society these conditions would be fulfilled by some necessary article of food or clothing. Even after a foreign commerce had sprung up, some staple commodity of export would answer the purposes of internal trade. Adam Smith gives some curious examples of rude media of exchange, which will serve to illustrate what I have said. "Salt is said to be the common instrument of commerce and exchanges in Abyssinia; a species of shells in some parts of the coast of India; dried cod at Newfoundland; tobacco in Virginia; sugar in some of our West India Colonies; hides or dressed leather in some other countries; and there is at this day a village in Scotland where it is not uncommon, I am told, for a workman to carry nails, instead of money, to the baker's shop or the ale house."

As cattle principally constituted wealth in primitive ages, so they most probably were the first 'money'—inconvenient and rude, but forming a connecting link between pure barter and the use of a recognised circulating medium. Adam Smith, in the passage of which I have quoted a part, enumerates cattle amongst the earliest examples of money, and quotes Homer's account of the interview between Glaucus and Diomede in support of the fact. Their respective suits of armour are there expressly valued at 100 *beeves* and 9. The Marquis Garnier, in a note to his Translation of the wealth of Nations, asserts that Smith misinterprets the passage—that the *βοες* were coins stamped with the figure of an ox, not

bonâ fide oxen themselves. I do not think the Marquis' view correct; but even if it be, it is more than probable that cattle were employed as money at an earlier time; the name of a coin, if Homer did mean a coin, is a confirmation. The most natural and obvious design for the earliest coins would be the figure of that rude medium of exchange which they supplanted.*

As intercourse became more free and commerce more extended between different nations, it became necessary to employ some circulating medium of intrinsic value and universal acceptability. Cattle, it is true, fulfil these two conditions; but such money was too bulky and inconvenient for the purposes of even internal trade, except in the very rudest stages of civilization, and still more unsuitable for effecting exchanges between different, and perhaps, distant countries. The close connection between even internal traffic and the use of a convenient circulating medium—of coin in short—is illustrated by two facts which Herodotus tells us with reference to the Lydians—that they were the first people who coined money, and also the first who carried on retail trades, *πρῶτοι κάπηλοι ἐγέ νουτο* (*Herod.* I. c. 94). Again, in the semi-mythical account of Lycurgus' legislation, we are told that in order to preserve the Spartans from the corrupting influence of foreign commerce, he forbad the use of gold and silver: only permitting a medium of exchange which no one outside the limits of the State would accept—which was so clumsy, too, and unwieldy, as to restrict considerably or altogether impede internal traffic. The subject of iron money will come before us again. The story of Lycurgus and his very eccentric Mint regulations, if

* Alison in his History of Europe, gives a curious instance of the revival in modern times of the primitive system of *barter*. In France, in 1796, after the excessive issue of assignats and their consequent depreciation to so great a degree that nobody would receive them at any value, (the metallic currency having almost entirely left the country), all who had any fortune left invested it in luxuries which might command a ready sale. The richest houses were converted into magazines for silks, &c., &c., and by the sale, or rather exchange of these, the proprietors managed to subsist. By this means internal trade regained in some degree its lost activity.

mythical, will at any rate show the feeling in the minds of its inventors that a convenient money was essential to trade and civilization of any high order. The Spartans were certainly far behind most of the other peoples of Greece in civilization. In the art of war, and everything essential to success in military matters, they excelled: but we know that such excellence is quite compatible with barbarism, or at any rate with a condition but little superior. If the Greek historians sought a reason for Lacedemonian inferiority in civilization, the isolation of the Spartans and their aversion to commerce accounted for it. If a cause for these was wanting, they could not have invented one more plausible than the necessity imposed by their great legislator, of using an absurdly inconvenient medium of exchange. Indeed we have no clearer means of estimating an ancient nation's advance in civilization than that which its coins supply. On this Mitford remarks: "Coins are singularly adapted to convey to late ages and distant countries exact information of the progress of art and fine taste:" and his account of the coins of Sybara, describing them as "of a beauty that modern art will with difficulty rival," tallies with the proverbially high civilization which we ordinarily attribute to its people.

The universal acceptability of the metals, and more especially of gold and silver, as well as their peculiar fitness for the purpose in other respects presently to be examined, soon led to their employment in the form of coin. But I need scarcely say that their value was antecedent to, and altogether independent of, their employment in this manner. The demand for the metals in general arises partly from their utility, partly from their beauty. Their relative value depends upon demand, scarcity, and *cost of production.* This last element of value it is most important to keep in mind, especially in considering the relative values of the precious metals. It is a natural and a common mistake to suppose that if silver is in a certain proportion more abundant than gold, either in the commercial world generally or in any particular country, that it is less valuable in *the same* proportion. Speaking roughly, silver is forty times more abundant than gold, but is not more than fifteen times less valu-

able. The difference in value is due to the difference in cost of production.

Accordingly, in the earliest records we possess, not only do we find mention of several metals—" the precious" included—and traces of considerable advance in the metallurgy of these as well as of the less valuable, but also evidence of the use of silver as coin; while gold holds a position as the most valuable, indeed, of metals, but more for ornamental than for useful purposes. The date of the Book of Job is unknown. Some Jewish writers assign to it an antiquity higher than the time of Moses, asserting that he translated it from the Syriac for the purpose of consoling his countrymen in Egypt. By others Moses is supposed to have been the author. All agree in believing the book not to be of later date than his time. Whatever the author's age may have been, we obtain from the Book of Job evidence of two or three facts connected with the foregoing remarks. Before proceeding to these, I may state that the internal evidence derived from passages relating to my subject, seems to me to establish that the book in question is of much greater antiquity than the Pentateuch.

The facts I wish to deduce are these. First, that at that early period, considerable skill in metallurgy had been attained. Secondly, that money was in use. Thirdly, that that money was silver only. Fourthly, that money was not then so highly esteemed as a medium of exchange, and therefore as an evidence of wealth as it afterwards became.

For the first, I need only quote the following passages—vi. 12, " is my flesh of *brass?*" xxviii. 1, 2, " Surely there is a vein for the silver, and a place for gold where they fine it. *Iron* is taken out of the earth, and *brass* is *molten out of the stone.*" xxxvii. 18, " a molten looking glass" (or rather ' speculum.')

Secondly: xxxi. 39, " If I have eaten the fruits thereof without *money.*" xlii. 11, " every man also gave him a piece of *money.*"

Thirdly: this latter passage speaks of a " piece of money" *(silver)* and an " ear-ring of gold;" which, taken in connection with other facts to be mentioned hereafter, seems to imply the non-existence of *gold* coin.

Fourthly: in the enumeration of Job's wealth, both before his troubles and after, there is no mention whatever of *money.*

I should not have brought forward illustrations of the obvious principle that the value of the precious metals is antecedent to, not consequent upon their use as coin, but that I think the facts I have adduced are curious and interesting in themselves. I shall only add that in the Book of Genesis, "gold" is first mentioned in the description of Eden (ii. 11, 12); "money" in xvii. 12; *silver coin,* in xx. 16. I must not trespass on another division of my subject. My object at present is merely to offer a few remarks on money in general.

Their permanence, divisibility, and small bulk in proportion to their value render the metals, gold and silver more especially, the best possible material for a currency. An important advantage arises from the last quality I have named, viz., the almost perfect equalization of value of the precious metals, over all parts of Europe at least. Even at a time when the trade in gold and silver was almost universally restricted by legislative enactments, owing to the erroneous principles of the Mercantile System, their value in the different European countries remained very nearly the same. The proportion between their bulk and their value gave facilities for smuggling more powerful to encourage than law was to repress their transfer: and whenever these arose from any cause, even a slight difference of value in any two countries, the mercantile instinct soon found means of conveying the precious metals from that in which they bore a lower to that in which they bore a higher price. At the present day, when in England,* and I believe in all other European countries, the trade is perfectly free, an exaltation in value of gold and silver to the amount of *one-eighth* per cent. in any place in Europe, is sufficient to determine thither such a supply as to restore immediately the normal level.

But a metallic currency, though the best possible is far from perfect. The fluctuation in the value of the material is a serious drawback. Another is the heavy expense of maintaining a circulating medium consisting of the precious metals. The former,

* Since 1816.

though not of frequent occurrence, (the relation between supply and demand remaining generally constant), involves, when it does occur to any considerable extent, great commercial disturbance, and much distress both to individuals and to nations. Any considerable rise or fall in the value of the precious metals must exercise most important influence upon the relation between debtor and creditor—whether the latter be fundholder or mortgagee, or simply a retail trader. If a man owes 100 rupees, and the discovery of new mines reduces silver in value one-half, he can pay the debt with half the money: that is, he can obtain the amount of silver necessary for the discharge of his debt with one-half the amount of labour which would have been requisite before the fall I have supposed. A rise in value (somewhat less likely to occur) would of course be attended by opposite results.

As examples I may mention that, after the great influx of the precious metals into Europe, consequent on the discovery of America, in the 16th century, their value in the European markets fell to one-third of what it had been previously. Again: when the revolutionary disturbances commenced in Mexico and South America, mining operations being interrupted, the supply of the precious metals from those countries was greatly diminished. For many years the annual importation was only one-fifth of what it had been; sometimes as little as one-tenth, and for several years no gold or silver whatever came from the Mexican mines. On the whole, between 1810 and 1830, the average annual supply was not more than one-third of what it had been in the twenty years preceding. But during the same time, while supply was diminishing, demand was increasing; the requirements of commerce and of luxury—the one for coin, the other for plate and ornaments —were becoming more imperious. An attempt made to work the mines with British capital failed. The value of the precious metals rose considerably all over Europe, and very great distress ensued. How dreadful the consequences of this fluctuation in the value of the precious metals appeared to Sir A. Alison's peculiar mind is evident from his tracing the Reform Bill; what he calls the 'Revolution of 1832' to the events I have detailed.

When, at a more recent period, the supply of gold became enor-

mously augmented by importations from California and Australia, and increased quantities from Northern Asia, it was feared that much commercial distress would ensue. Hitherto, so far as I am aware, the ill effects so naturally expected have not resulted. The immense extension of commerce and increased demand for gold for ornamental purposes, have most probably hitherto absorbed the extra supply.

The very serious expense attending upon the maintenance of a medium of exchange consisting principally of the precious metals, though perhaps a less obvious disadvantage, is not less real than the other, and scarcely less important. This will be evident from the following calculations taken from a Note by Mr. McCulloch.

The French currency was estimated by Necker at 2,200,000,000f; by Penchet somewhat lower at 1,850,000,000f. Taking the mean of these two estimates, and allowing six per cent. as the ordinary rate of profit, the expense of maintaining as coin 2,025,000,000f. will be 121,000,000f. To this must be added the loss by wear and tear, by fires, shipwrecks, &c., which must of course all be made good by the public, and which cannot be estimated at less than one-hundredth of the whole, or 20,000,000f. These two sums make up 141,000,000f. or £5,640,000.

Or, supposing fifty millions of sovereigns to be in circulation in England, (£57,000,000 of gold was coined in the reign of George III), and allowing five per cent. as the rate of profit, the expense of maintaining in circulation these alone would amount to £2,500,000 annually; and I think we may with McCulloch fairly estimate losses at £500,000, raising the cost to £3,000,000 per annum.

The MATERIALS which have been employed for metallic currency are—GOLD, generally if not invariably alloyed—naturally with silver and copper, intentionally with copper; SILVER, pure, or containing a little gold, or alloyed with copper; ÆS or BRONZE, commonly translated "brass" or "copper;" COPPER; AURICHALCHUM or ŒRICHALCHUM; IRON; PLATINUM; and ZINC. Some other materials will be mentioned when I come to speak of Depreciation of Currency.

The last three materials may be dismissed in a few words.

I have alluded to the story of Lycurgus and his iron coins; and other states besides the Spartan are said to have adopted iron as a medium of exchange, whether totally, as in that supposed case, or only partially, I am unable to say. Byzantium is named as one of these. A more unsuitable metallic material could scarcely have been selected. The great tendency of iron to destructive oxidation deprives it of one of the advantages I have enumerated as leading to the employment of *metal* money; iron cannot be *permanent.* This circumstance may perhaps account for a fact which at first view seems calculated to destroy our belief in iron coin altogether; no specimen of Spartan or Byzantine or any other ancient iron coin is extant.

The Britons in the time of Julius Cæsar used iron rings for money; and I have seen some curved pieces of wrought iron which I was told were coins in Western Africa.

These are all the instances of iron currency of which I am aware.

Platinum was at one time used for coin in Russia. I do not know whether the practice has been discontinued. Its hardness, durability, and high comparative value would seem to make it a suitable material, if these advantages are not counterbalanced by its scarcity (being only found in two or three places in the world,) and the great difficulty of manufacture. It is worth four or five times its weight of silver, or about one-third of gold. Its employment for coin would of course raise its value.

With respect to zinc, I have seen it stated somewhere that it has been coined by the Chinese. It offers many advantages for the purpose. The process of obtaining the metal from the ore was invented by the Chinese, and surreptitiously obtained by an Englishman long after it had been in use amongst them.

In the earliest time of which we have any record, gold was known and valued; and early used as an instrument of exchange, though not always as "money" in the strict sense of the word. Its beauty and its being most usually found native would naturally make it known perhaps before any other metal. In the Hebrew Scriptures it is mentioned in almost every page, but frequently in such a manner as to confirm Bishop Patrick's statement (on Gen.

xx. 16) that "anciently there were no shekels of gold or brass but only of silver." Some passages I have already quoted. One or two more will be sufficient. In Numbers xxii. 18, Balaam speaks of Balak's giving him his "house full of silver and gold"—putting the less valuable metal *first*. A still stronger passage is Joshua vii. 21, in which Achan confesses that he had appropriated "two hundred *shekels* of *silver*, and a *wedge* of *gold* of fifty shekels *weight*." I might adduce many other instances in which gold is expressly mentioned as paid *by weight*, though, as we shall see presently, silver also was weighed in payment. This difference of language implies that the one was a valuable commodity used in lumps or ingots; the other broken up into pieces of convenient size—or coins,—but yet, (in the absence of obvious evidence that each piece really contained the value it professed) weighed in payments as the English sovereign is still payable by weight, not tale.

There is one curious exception. In 2 Kings v. 5, we read "ten talents of silver, and six thousand [pieces] of gold." The word "pieces" is not represented in the original, but is supplied by the author of our version in this passage, as in very many where we read "pieces of silver." The Arabic version translates "*shekels* of gold." Now this money was brought by Naaman as a present for Elisha, and the gold coin was SYRIAN not Hebrew.

A few words upon the source from which the Jews obtained their supplies of gold may not be uninteresting. When we read of the "gold of Arabia," the matter is plain enough; and Diodorus Siculus informs us* that in that country gold is dug up in great lumps as large as a chestnut. We are also told that it was so abundant there as to exchange for one-half or one-third its weight of brass or iron! But the gold of OPHIR is mentioned in numerous passages—in the book of Job (xxii. 24) for instance. From Ophir Solomon imported his supplies; and there has been some controversy as to its position. It seems most probable that there are two different places called Ophir in the Sacred Writings: one in Arabia Felix, to which Job alludes, the other in India, or rather Zeilan or Ceylon, anciently Taprobāne. There certainly was

* Lib. ii. p. 93, Edit. H. Steph.

an Ophir (called by the LXX and by Josephus Σόφιρ, and by others 'Ορφῆν) in Arabia Felix: but Bochart shows that this cannot be the place to which Solomon sent for gold. His proofs are simple and conclusive. First, it was a three years' voyage to the latter place; secondly, the ships which brought the gold brought also *ivory*—and in Arabia there are no elephants.*

Another opinion is that of Huctius who believes Ophir to be identical with Sophala in Eastern Africa.

Wherever Ophir may have been, the quantity of gold and silver brought to Palestine in the time of Solomon must have been immense. We are told that "silver was nothing accounted of in the time of Solomon;" that "the king made silver and gold at Jerusalem as stones." The yearly receipt of gold is stated at 666 talents (2 Chron. ix. 13,) "beside that which chapmen and merchants brought." 666 talents are considerably over £3,500,000, estimating gold merely at the mint price of the present day, without reference to the fall in value which it has undergone in 2,800 years.

In the later books of the Old Testament we find the words *adarkon* and *darkêmon* in connection with gold, and translated "drams" in our version.† The words are evidently closely allied to the Greek δραχμη from which, through the Latin, our "drachm" or "dram" is derived. I mention them here because they form a connecting link between the subject upon which I have been engaged, and the few facts I have collected with reference to PERSIAN currency. The words are supposed to be connected with δαρεικος—the "daric"—the most important gold piece in circulation amongst the Persians. This coin is said to have been named after Darius Hystaspes who, we are told by Herodotus, reformed the Persian gold coinage. Estimated at the present value of gold, the Daric was equal to £1-1-10, 1·76f. It circulated freely in Greece: and Xenophon, in the Anabasis, informs us that it was the monthly pay of the heavy-armed Greek soldiers whom

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* 1 Kings x. 22—"once in three years came the navy of Tharshish, bringing gold, and silver, ivory ['elephants' teeth' *in the margin*], and apes, and peacocks."

† 1 Chron. xxix. 7, Ezra ii. 69, viii. 27, Neh. vii. 70, 72.

Clearchus commanded in Cyrus' expedition against his brother Artaxerxes. The piece is now rare, having been re-coined by Alexander the Great after his conquest of Persia.

Philip and Alexander of MACEDONIA issued gold "staters." These coins contained no alloy except a little silver. They were recently current in Greece at a value of 25*s*. each.

The LYDIANS are said by Herodotus to have been the first people who coined gold and silver. At any rate, the earliest gold coinage known in Greece was the Lydian stater, issued by Crœsus. The oldest gold coins extant are Lydian, and their execution is very elegant. The mountain Imolus, in Lydia, abounded in gold, which the celebrated Pactolus carried down. To this cause the early rise and prosperity of Sardis, built at its foot, are to be attributed. Böckh says, that the Pactolian gold was *electrum*, which Pliny defines to be four-fifths gold and one-fifth silver. The supply from this source must have been very considerable. We know that Crœsus, besides his coinage, deposited large quantities of gold in ingots in the Temple at Delphi.

From a very early period the Asiatic nations, the Greek cities of Asia Minor, and others in Sicily and Magna Græcia had coined gold. I have already mentioned the Sybarite coinage, probably derived through Miletus from Lydia. We have extant, coins of Gelon, Tyrant of Syracuse and of his successor. The former obtained his sovereignty B. C. 485, according to Clinton's dates. But coming to GREECE properly so called, we find no gold currency until much more than a century after this. Gold seems to have been rather scarce in Greece. The supply came from Asia Minor and the adjacent islands chiefly; though not entirely, for the Athenians possessed gold mines in Thrace, though they did not coin the produce. The gold coin which was in circulation in Greece, before the rise of the Macedonian power, came chiefly from the same source in the form of the tribute paid to the Athenians by their so-called "allies." Persian darics and Macedonian staters circulated; but (with one exception) the Athenians coined no gold until the period I have mentioned—that of Macedonian supremacy. At that time gold became more abundant in Greece

and other States, as well as Athens imitated the example of the dominant power and issued gold coins. Previously to this period when gold money is mentioned, it is in such a manner as to imply that it was foreign; and the genuine Athenian gold coins which remain to us are evident imitations of the work of the Macedonian mint.

I have alluded to one exception. Near the close of the Peloponnesian war—in fact in the year 407 B. C., the year before the disastrous action of Ægospotamos—the Athenians were reduced to the necessity of transmuting into coin some " golden" statues of victory. This issue was most debased; contrasting strongly with the extreme purity of the regular currency. It was in every sense an exception.

Pliny gives the year 207 B. C. as the date of the first issue of gold coin by the ROMANS. This was 62 years after their first coinage of silver, and more than a century after the issue of gold by the States of Greece. The principal gold coin of the Roman Republic and Empire was the *aureus nummus*, or *denarius aureus*. Of course the weight of this coin underwent gradual diminution —to be specified hereafter. It still, however, maintained its relation in weight to the silver denarius (2:1). The latter under the early Emperors weighed 60 grains, and consequently the aureus 120.

The material was very pure, containing no intentional alloy, and only one three-hundredth part of silver. The coin consisted therefore of 119·6 grains of gold and 0·4 grains of silver. The English sovereign contains 113·001 grs. pure gold. Hence the aureus of the early Roman Emperors=£1-1-2.*

The most productive gold mines belonging to the Roman Republic were at Aquileia, and Ictimuli, and Vercelli.

In ENGLAND, there was little gold coin in use before the reign of Edward III: nor was it made a legal tender until long after.

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* I shall state here once for all, that the value of ancient coins in modern English money, as given in this paper, are irrespective of the fall in the value of the precious metals which has taken place since the currencies were in use.

The English gold coin has deteriorated both in weight and material. The latter has undergone *two* important changes; the increase of the copper alloy, and the extraction of the silver from the gold. In the reign of Henry III. the gold standard contained 23 carats $3\frac{1}{2}$ grs. of pure gold to $\frac{1}{2}$ gr. alloy. The present standard was fixed in James I. It contains $\frac{1}{12}$ alloy; in technical language it is "22 carats fine."

The other change in material was introduced in 1826. Before that year the British standard gold contained an appreciable amount of silver. The coins struck previously are, consequently, perceptibly paler than those now current. This silver being part of the alloy—being rated as copper in estimating the mint value of the coin—it was of course profitable to melt down the gold pieces in order to extract the silver. On this account the present system was adopted of extracting all the silver from the gold before coining the latter. This had the desired effect: but the end might have been gained in a better way, namely, by retaining the silver in the alloy and making it part of the value of the coin. The addition of copper to the gold renders the material harder and more fusible than either constituent; but the best alloy for gold for mint purposes is composed of equal parts of silver and copper.

One pound Troy of English standard gold is coined into $46\frac{29}{40}$ sovereigns—(formerly into $44\frac{1}{2}$ *guineas*); or 20 lbs. into $934\frac{1}{2}$ sovereigns. Therefore one sovereign weighs 123·274 grs. Troy, gold 22 carats fine, and contains 113·001 grs. pure gold.

An ounce Troy of *pure* gold is worth £4-4-$11\frac{1}{4}$ $\frac{5}{6}$ nearly—of British *standard* gold (one-twelfth less), £3-17-$10\frac{1}{2}$. *This* is the "mint price" of standard gold.

I subjoin a Table of British gold coin, abridged from Brande's Chemistry.

Number of pieces in the pound weight.		Standard weight of each piece.			Fine gold in each piece.			Current weight of each piece, not to pass below			Allowance for current wear.	By Mint regulations the Bank must receive if not heavier than			Legal Tender.	Stand-weight in Troy grains.
		oz	dwt	gr.	oz	dwt	gr.	oz	dwt	gr.	gr.	dwt.	gr.			gr.
178	$\frac{1}{4}$ Guineas.	0	1	8·35	0	1	5·66	0	1	8	·35				To any amount.	32·359
$133\frac{1}{2}$	$\frac{1}{3}$ do.	0	1	19·14	0	1	15·55	0	1	18	1·14					43·146
89	$\frac{1}{2}$ do.	0	2	16·71	0	2	11·32	0	2	16	·71					64·719
$44\frac{1}{2}$	Guineas.	0	5	9·43	0	4	22·65	0	5	8	1·43					129·438
$22\frac{1}{4}$	2 do.	0	10	18·37	0	9	21·30	0	10	16	2·87					258·876
9 wanting $\frac{1}{2}$ guinea.	5 do.	1	6	23·19	1	4	17·25	1	6	16	7·19					647·191
$93\frac{9}{20}$ or 1869 in 20 lbs.	$\frac{1}{2}$ Sov.	0	2	1·363	0	2	8·500	0	2	13·125	$\frac{1}{2}$ = ·512	2	13	803 = $\frac{1}{6}$ gr. above standard		61·163
$46\frac{29}{40}$ or $934\frac{1}{2}$ in 20 lbs.	Sov.	0	5	3·27	0	4	17·001	0	5	2·5	$\frac{3}{4}$ = ·774	5	3	607 = $\frac{1}{3}$ gr. above standard		123·274
$23\frac{1}{4}$ & $\frac{9}{80}$	£2 pieces.	0	10	6·54	0	9	10·003	0	10	5	1·548					246·548
9 & $\frac{69}{200}$	£5 do.	1	5	16·37	1	3	13·005		..		..					616·372

The French gold coin consists of nine parts pure gold and one part copper. The silver is removed as in the English system. The French Mint allows a *tolèrance* of ·002—above and below standard. Their standard gold for medals is finer 0·916, with the same *tolèrance.* There are three standards for jewelry; 0·750, the commonest, 0·840 and 0·920, little used. The *tolèrance* is 0·003 *below* standard. There is no superior limit—Jewellers in Paris, or elsewhere, not being likely to put an excess of gold into their manufactures.

In the British metallic currency gold preponderates greatly. Adam Smith says it was so in his time, and the preponderance has increased considerably since he wrote. He also states that in the Scotch currency before the Union there was a slight preponderance of gold; but that in France "the largest sums are paid in silver and gold is very scarce." We know that in this latter respect matters are very different in our day.

I add a small Table giving a comparative view of the values of the principal gold coins in the chief commercial states of the world.*

COIN.	Weight grs.	Quantity of pure gold.
Sovereign..............	123·274	113·001
Napoleon..............	99·564	89·610
10 florin piece, (Dutch)..	103·880	?
Eagle, (American)......	269·850	232·000

I shall conclude the subject of gold currency with a few lines on the sources from which (independently of California and Australia) Europe has derived her supply of gold and silver. I include silver here partly for convenience, and partly from the impossibility of separating it from gold in some of the statistics which I shall bring forward.

* I have somewhere seen a calculation which gives a popular idea of the amount of gold currency in the world. For its correctness I will not vouch. It estimates the value at £150,000,000; and states that this would weigh 1,150 tons, and could all be contained in a room of the dimensions of 20 feet × 12 × 10.

From the discovery of America about the beginning of the 16th century until recently, the mines of Mexico and South America were the principal storehouses from which Europe drew her supplies of the precious metals. America supplied 0·9 of the produce of the entire globe. As an example I give Humboldt's estimate of the values of gold and silver derived from America and the other sources respectively in the year 1809. He also gives the relative proportions of the two metals to each other, which I add.

		Gold.		Silver.
Europe........£	640,000	4·5	:	11·7
Northern Asia..£	261,000	1·8	:	4·8
America........£	9,841,000	59·5	:	176·8
	£10,742,000	65·8	:	193·3

A few figures will give a clear idea of the enormous quantities of gold and silver which the American mines produced previously to the revolutionary disturbances in 1810. From 1545 to 1810, the gold raised in the Cordilleras, Mexico and South America amounted to £337,150,000 ; the silver, (which it is said would have formed a globe 85 feet in diameter,) to £1,089,050,000. Total, £1,426,200,000.

Potosi was discovered in 1545. Between that year and 1803 it yielded silver to the value of £230,000,000.

Mr. Meggens, quoted by Adam Smith, gives estimates of the amount of the precious metals imported into Spain and Portugal ; based in the case of Spain upon the average of six years, 1748 to 1753, in the case of Portugal upon an average of seven years, 1747 to 1753.

Silver :	1,101,107 lbs. troy,	at 62*s*. per lb....	£3,413,431	10 0.
Gold :	49,940 do.	at 44½ grs. per lb.	£2,333,446	14 0.
		Total....	£5,746,878	4 0.

The Mexican mines were twice as productive of both metals as those of Peru and Buenos Ayres. Between 1695 and 1803 the produce of the former multiplied *five-fold*. In 1775, the annual receipt of coin and bullion by Spain and Portugal amounted to

£8,500,000, (understated at £6,000,000 by Adam Smith.) The demand increasing in consequence of the exigencies of European war, in 1803 the supply amounted to £10,000,000, of which £9,000,000 came from the Spanish colonies.

It is easy to conceive the effect produced on prices all over the world by this enormous increase of the precious metals, the universal and rapid rise of nominal value: and again its subsequent fall, to which I have before alluded, when the revolutions checked supply, demand continuing unabated.

SILVER appears to have been a more favored material for a currency than gold. In most countries its use as a medium of exchange preceded that of gold by many years. Of it alone, for centuries, consisted the money of Palestine and of Greece. I have mentioned that in Rome too, where it was not the original medium of exchange it was coined more than half a century earlier than gold. Amongst the Northern peoples who overturned the Roman Empire it formed the only material of currency; and from them it was adopted by England and the modern continental States. In the East, as we know, it continues to the present day to be the principal; in some places the sole medium of exchange.

In the HEBREW Scriptures silver money is mentioned at a very early period; in many passages, *ceseph* literally silver is used to express money in general.) I have before given an instance from the book of Job. I have also quoted Gen. xx. 16, where Abimelech gives Abraham "a thousand [pieces] of silver." "Pieces" is inserted by the translators. The word "shekel" understood by the Jews in this passage and elsewhere when no coin is named,* itself occurs for the first time in Gen. xxiii. 15; 400 shekels of silver are the price of the burying place which Abraham buys.

As to what may have been the style of execution of these shekels—or how far they may have corresponded with our ideas of 'coin'—I have no information. The Jews tell us that Mordecai, David, Joshua, and Abraham issued coins. In support of the last part of the story, on the truth of which an *a fortiori* argument

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* The "threescore and ten [pieces] of silver" in Judges ix. 4, are by some commentators supposed to be *pounds weight:* for no other reason than that the sum seems too small if *shekels* be understood.

might be built, they forged coins bearing effigies of Abraham and Sarah on one side and of Isaac and Rebecca on the other. These articles do not throw much light on the matter. It would seem that whoever issued the shekels current in Canaan, both before and after the Hebrew occupation of the country, they did not bear any certain external evidence of containing the due amount of silver. The being issued from one well known and trustworthy mint might have conferred, but they evidently did not possess it. The very word *shekel* is derived from *shakal*, *he weighed*, Abraham weighed the "four-hundred shekels of silver current with the Merchant." Even at so late a period as that of the captivity Jeremiah "weighs" seventeen shekels of silver, (Jer. xxxii. 9—cir. 590 B. C.)

As to the value of the shekel; Josephus tells us that it was equal to four Attic drachma—'Αττικας δεχεται δραχμας τεσσαρας. This would make it half an ounce of silver. It is generally estimated at 2*s*. 6*d*. which is a little less than the mint price of half an ounce of silver. Bp. Cumberland computes the *gerah*, (one-twentieth of the shekel,) to be equal to the Attic obolus—eleven grains of silver. He estimates the shekel at a little more than 2*s*. 4¼*d*.

From 1st Kings x. 22, we learn that Ophir supplied the Jews in Solomon's time with silver as well as gold.

In Greece, silver currency was the oldest. '-Αρηυρος (silver) is used for "money" in general—as the Hebrew *ceseph*, the French *argent*—the Saxon or Lowland Scotch *siller*. All Greek words relating to money (e. g. *usurer*, *mint)* are derived from ἀρηυρος.

According to Herodotus (I. 94) the Lydians were the first to coin silver as well as gold; but the evidence of the most ancient authors is in favour of the Æginetans; and the date of the first coinage of silver in Ægina was B. C. 869. The oldest Æginetan coins are very rude and thick, and have an indented mark, as if from the blow in striking. Greek coins of the age of Pericles and Xenophon are still thick, but much less clumsy than their predecessors. Later specimens are broad and thin. In fact, there are three well-marked classes of Grecian silver coins.

The material of all is very fine, more especially of those issued

by the Athenians, who were very proud of the fineness of their coinage. Xenophon tells us that in his day the Athenian currency could be exchanged with profit in any market. Analysis of extant specimens has confirmed this statement. The earlier Athenian coins contain $\frac{1}{28}$ alloy; later, $\frac{1}{60}$; at a still more modern date, $\frac{1}{12}$—nearly the same as in our own currency.

The principal Grecian silver coin was the DRACHMA, and in this money was counted. There were several drachmæ in circulation in Greece, of which the principal were, the ATTIC, usually estimated (before its depreciation) at $9\frac{3}{4}$*d.*; and the ÆGINETAN at 1*s.* $1\frac{3}{4}$*d.* The former standard was adopted in Philip's gold coinage, and afterwards in Alexander's silver. I may mention that the Athenian currency was called in and recoined by Hipparchus, who died B. C. 512.

The Athenians obtained their silver from Laurion in Attica. These mines are said by Xenophon to have been the most impotant source of Athenian revenue, they were let to contractors on condition of payment to the state of a per-centage of the ore raised. This rent varied; at one time it is said to have been so low as one-twenty-fourth of the produce.* Xenophon speaks of these mines as having been worked from remote times and as being inexhaustible. However in the 2nd century of the Christian Era they were abandoned.

At ROME, silver coins were not struck until B. C. 269, five years before the commencement of the First Punic War. The principal Roman silver coin was the DENARIUS,† which was worth 10 ases, or 10 pounds of *æs*, and of which there were originally 84 to the pound. At a later period we find the pound of silver coined into 96 denarii, but when this change was introduced is unknown. If we suppose it to have taken place previ-

* In the silver mines of Peru, until 1736, the tax payable to the King of Spain amounted to *one-fifth* of the standard silver. After that year it was *one-tenth*, and this was ill-paid. The tax on gold was originally *one-fifth*, reduced first to *one-tenth*, and then to *one-twentieth*. These taxes constituted the whole RENT of the mines. *One-sixth* of the gross produce is the average *rent* of the tin mines of Cornwall: (there is besides a *tax* to the Duke of Cornwall of about *one-twentieth*); and of very fertile lead mines in Scotland. The rent of a coal mine is about *one-tenth* of the gross produce. (Adam Smith and N.)

† The word is retained in the Italian for "money"—*danaro*.

ously to the year 50 B. C., we should have to infer, from the known proportions between the silver, gold, and bronze coinage of that date, that gold bore to silver the ratio of 7·8 : 1—which is too low to be admissible. In the later Commonwealth the denarius was worth $8\frac{1}{2}$*d.*

The Roman silver coin was never so pure as the best Athenian. Under the Emperor Gallienus (A. D. 259-268) the natural order of things was so completely reversed that the *silver* coinage consisted of $\frac{1}{5}$ silver and $\frac{4}{5}$ alloy.

The mines near Carthago Nova in Spain, chiefly supplied the Roman Republic with silver. They are said to have been so productive as to yield 25,000 drachmæ daily.

In England, the Saxons had a silver currency, and no other. Tribute, however, was paid *in kind* until the Conquest, when William ordered it to be paid in money, this money was paid *by weight.* In those days a pound was a bonâ fide pound. A penny too, English and Scots, was a genuine *pennyweight* of silver. In fact as we ascend towards the origin of coin in every land, the distinction between coins and weights vanishes. Adam Smith quotes a passage which proves that the *shilling* too was originally a weight, though before William the Conqueror its proportion to the pound above and the penny below was not constant. At one time we find the Saxon shilling equal to *five* pence. The penny seems at all times to have borne its present fixed relation ($\frac{1}{240}$) to the pound, and William fixed the varying shilling, the proportions between the three denominations have remained the same from his time to ours.

In the reign of Edward I. the English pound sterling was a pound, Tower Weight, of silver of certain known fineness. This Tower pound was a little more than the Roman—a little less than the troy-pound, which latter was introduced into the mint in 15, Henry VIII. The Scots pound from Alexander I. to Robert Bruce was a pound of silver of the same weight and fineness as the English. From that day when the troy pound of standard silver was coined into 20 shillings to the present when 66 are struck from it, the depreciation has been considerable; but most or all of it was previous to the reign of Queen Elizabeth. Since Philip and Mary, both the denomination of the English coin has

undergone no alteration, and the same number of pounds, shillings, and pence have contained very nearly the same quantity of pure silver.

Until 1816 the Troy pound of standard silver was coined into 62 shillings; the mint price of silver, therefore, was 5*s.* 2*d.* an ounce. *This* continues so; although since that year the pound is coined into 66 shillings. The additional four are retained as seignorage.

Many ancient silver coins (I might say *most*), and many modern Oriental, contain no intentional alloy—their only impurity is a trace of gold or copper. In the modern European currencies, on the contrary, every trace of gold is carefully removed and copper added—the former for economy, the latter to give greater durability to the coin. Alloying for this purpose is even more necessary to silver than to gold; because the less the value of the coin, the greater its circulation—a shilling changes hands *more* than twenty times as often as a sovereign, and is therefore more than twenty times as exposed to wear.

Copper added to silver increases its sonoriety* and hardness. The *maximum* degree of the latter is presented by an alloy of $\frac{4}{5}$th silver with $\frac{1}{5}$th copper, but so much hardness is unnecessary—so much depreciation unadvisable. The color of the silver is but very slightly impaired by the alloy—even equal weights of the metals giving a white compound.

When any alloy of silver and copper—the standard metal for English or French silver coins, for instance, is exposed to a red heat in air, the surface becomes black from the formation of a film of oxide of copper. If the piece be now immersed in hot sulphuric acid, the superficial black is removed and a beautiful white surface remains. Blanks for coins are treated thus before being struck. Hence the whiteness of new silver pieces, as well as their darker appearance after wear—the alloy beginning to show itself when the pure silver surface has been removed.

English standard silver contains 11·10 silver and 0·90 copper. A pound Troy therefore consists of 11 oz. 2 dwts. of silver and 18 dwts. of copper. The metals dilate a little in combination—

* Copper is the most sonorous of metals.

the actual density of the alloy being 10·3, while calculation gives 10·5.

I stated before that prior to 1826 the English gold coinage contained an appreciable amount of silver, which is not present in the later currency. In like manner the silver coin issued before that year contained (as the old Spanish dollars and some other foreign coins) a small proportion of gold. The relative value of different specimens of silver depend upon amount of gold they may include. The well-known Sycee silver contained a (comparatively) large quantity, and was valuable accordingly. But since 1826 the English silver coin has been as free from gold as the gold from silver. The metals are separated by means of hot concentrated sulphuric acid. The silver must amount to not less than 25 or 30 per cent. If the gold preponderate to a greater degree it exercises a protecting influence over the silver, preventing its solution: so that if the object of the process be to remove silver from gold previous to coinage, silver must be added to the alloy to bring the proportion up to the necessary standard. Further, there ought not to be more than 10 per cent. of copper present, sulphate of copper being little soluble in concentrated sulphuric acid. Regnault states that by this process one-two-thousandth part of gold may be extracted with profit.

I subjoin an abridgment of Brande's Table of British Silver Coinage.

Number of pieces in the pound Troy.		Standard weight of each piece.		Fine silver in each piece.		Allowance for current wear.	Legal Tender.	Standard weight in troy grains.
		dwt.	grains	dwt.	grains			grains.
792	Pence.......	0	7·27	0	6·72	Allowed to pass current without any limitation as to weight	Forty Shillings.	7·272
396	Twopences ..	0	14·54	0	13·45			14·545
264	Threepences..	0	21·81	0	20·18			21·818
198	Fourpences ..	1	5·09	1	2·90			29·090
132	Sixpences....	1	19·63	1	16·36			43·636
66	Shillings....	3	15·27	3	8·72			87·272
26& 1s.	Half Crowns.	9	2·18	8	9·81			218·181
13& 1*s.*	Crowns......	18	4·36	16	19·63			436·363

As might be expected the resemblance between the French and English currencies in early times is very close. The time of

Charlemagne in France corresponds in respect of coinage with that of William the Conqueror in England. In his time the *livre (libra,* pound) was a pound troy of silver of a certain known fineness; and bore the same fixed proportion (240 : 1) to the French penny—or penny weight of silver—that the English and Scots pound bore to the English and Scots penny. The *sou (solidus,)* corresponding to the shilling, agreed with it in variability until fixed by Charlemagne. At different times the sou was worth 5, 12, 20, 40, French pennys: and from Charlemagne till the Revolution the proportions between the French pound, shilling and penny remained uniform. The depreciation, however, was 22 times as great in the French as in the British currency.

The standard silver of France, like her gold, is somewhat inferior to that of England. It contains 0·900 pure silver, with a legal *tolèrance* of 0·003 above and below standard. Silver medals contain 0·950 with the same *tolèrance.* The standard for plate is also 0·950, but the *tolèrance* 0·015 *below*—no superior limit being fixed.

The gold is extracted as in the English Mint. The old 3-fr. and 6-fr. pieces, and the still older 5-fr. pieces, were deprived of their gold by the process above described.

When speaking of gold, I have given the sources from which the world is chiefly supplied with silver. The lead-mines of Great Britain and Ireland yield a considerable quantity. It is found both native, in streaks or threads in the lead ore, and in the form of sulphuret combined with the galena. It was formerly separated from the lead by oxidising the latter, which had again to be reduced to the metallic state. This process was so expensive that none but the most highly argentiferous ores would pay the cost of extracting the silver. Latterly, however, it has been found practicable to extract the silver by a process of crystallisation; and a proportion of three ounces in the ton may be separated with profit.*

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* The modern process does not require the oxidation of more than one-twentieth of the lead, instead of the whole.

The richest argentiferous galena contains no more than 40 oz. of silver to the ton. The average quantity in the Irish lead-mines is 28 oz. in the ton.

Æs was the material of the earliest Italian currency. It was a compound metal in which copper was the principal ingredient. The Italians translate the word by *rame*, or *otone;* the French by *airain:* the English call it *brass*—or people who wish to be particular say *copper*. All these words are vague, and worse—they are calculated to mislead. Brass is a compound of copper and *zinc*, but objects of ancient art, coins or others, to which the term *æs* is applicable contain no zinc. Their fundamental composition is copper and TIN. To this mixture we give the name *bronze*—a word probably derived from the Italian *bruno*, because the artists of the Revival gave that color to their metal works.

Æs or bronze, then, was much and variously used by the ancients, Greeks as well as Romans. Their ingenuity was exercised in attempts to vary its color and improve its texture by the admixture of sundry metals besides its two principal components. Analysis has detected gold, silver, lead, and iron in ancient works of bronze. Perhaps the best known and most highly prized variety was the Corinthian Bronze—said to have been discovered accidentally by the fusion together of various metals when Corinth was burned by Mummius, (B. C. 146). We find mention of it however before this date.

The ancients may have known the compound which we term *brass*. Zinc as a metal is mentioned first by Paracelsus, (who died 1541): but brass might have been, and at the present time frequently is, made without the intervention of metallic zinc—by heating together granulated copper and lapis calaminam (carbonate of zinc). I do not think, however, that there are any specimens extant of ancient Roman or Grecian brass. Certainly for the purposes of coinage bronze is preferable, being harder, and more fusible though less malleable. All alloys of copper and tin are hard; and often brittle if cooled slowly. It is a curious fact that "tempering" produces upon bronze the contrary effect to that which it has on steel. To make bronze fit for the coining-press it must be heated to redness and plunged into cold water.

The composition of the more ancient Greek bronze (χαλχος,) is very uniform. It is 88 copper to 12 tin. In modern times compounds of which the basis is copper and tin are used for vari-

ous purposes, Gun-metal, bell-metal,* and the material of bronze medals are examples. The ordinary proportions for "bronze" are 93 copper to 7 tin, and 89 to 11. The best for medals, giving maximum of tenacity, is 8 copper to 1 tin. The bronze of French medals is 95 copper and 5 tin, with a very slight admixture of zinc.

Of this æs or bronze the most ancient coinage of the old Italian States consisted. These are said to have coined from the earliest times, but as we have seen, silver currency was not introduced until a very late period. This fact is typified in the Italian mythology—Argentinus is the son of Æsculanus. In the Latin writers of every age *æs* is used for money in general, as we have seen that the equivalent of *silver* is employed in Hebrew, Greek and other languages. A Roman in debt is said "to have other people's *bronze.*"

Those very doubtful personages Janus and Saturnus are rival candidates for the honor of having first introduced coinage into Italy. The beginning of coinage in Rome is involved in similar mythical mist—only a degree less dense. Pliny asserts on the authority of Timæus that the Romans used stamped bars for a currency, until Servius Tullius introduced coins. Other say they coined from the building of the city. Both these are very shadowy epochs. Of the *material* of Italian and Roman coins, there is, however, no doubt whatever.

The first Italian coin was the AS, which began by being a pound weight of bronze. It soon fell from its high estate, in Rome as well as in other States. In the former, we shall see, its weight fell ultimately to half an ounce, even lower, but the depreciation was not uniform throughout Italy. Hence it became necessary to pay in this mixed currency *by weight;* and we meet the expression *æs grave*, meaning money so paid. One hundred ases of *æs grave* always contained the same amount of metal. The *as* was divided into 12 parts, and there were six of the subordinate denominations represented by coins. The silver denarius of which I have spoken was originally equal to 10 ases.

* In a lecture on Bells recently delivered in London by Mr. Denison, he states, that modern copper will not combine with so great a quantity of tin as the ancient metal.

The *sestertius*, as its name implies, and as its symbol HS represents was originally equal to $2\frac{1}{2}$ ases. Large sums were generally counted in this coin. It was afterwards made equal to 4 ases and its material changed.

At ATHENS, coins of this metal were issued in the year 406 B. C., a critical time in the history of the Athenian people. These, however, were soon recalled. It is probable that a coin called *chalkus* (χαλοῦς) and equal to one-eighth of the obolus, was in circulation before this period; and not recalled after it: and that the temporary issue consisted of coins of higher denominations. The quarter obolus was the smallest silver coin. Convenience would suggest that pieces of lower value should be made of cheaper material. We find the chalkus afterwards divided into seven lepta—the mites of the New Testament.

Finally, as early as B. C. 185, we see mention of whole talents being paid in bronze by Ptolomy Epiphanes.

Before I leave the subject of coin made of a combination of copper and tin, I may mention that *two* forms of this compound are at present in circulation in France. One, averaging 86 copper and 14 tin, is genuine bell-metal and in color yellow; the other, refined bell-metal, averages 96 copper and 4 tin. Both these were struck under the old Republic. They might perhaps have better been put under the head of Depreciations: but in all countries, so far as I am aware, copper coins bear a conventional value higher than the intrinsic, and bell-metal answers the ordinary purposes of a token or counter as well as copper, pure or impure.

COPPER will not detain us long. Its hardness, durability and abundance eminently fit it for being the material of the lowest denominations of coins; and it is thus used by all civilised nations. It is overvalued in most currencies, and its conventional value maintained by the amount of silver to which it is legally equivalent; while the restrictions upon the extent to which it is a legal tender prevent the evil which would result from the payment of obligations in a depreciated coin. Adam Smith says that in his time half a pound of impure copper, not worth 7*d.* was coined into 12 pence; and I do not think there has been any improvement in the intrinsic value of the copper currency since his time: nor is any necessary.

England had no copper coinage until James I. I subjoin Brande's Table.

Denomination of coin.	No. of pieces in the lb. Avoir.	Weight of each piece.		Value of one lb.	No. of pieces in a ton.	Value of a ton.	Legal Tender.	Date of proclamations fixing amount of legal tender.	Where current.
		In drs. Avoir.	In Troy grs.						
Pence.	24	10·66	291·66	Two Shillings.	53,760	£ 224	12*d.*	14 Nov. 1821	United Kingdom and British Colonies.
Half-pence.	48	5·33	145·83		107,520		6*d.*	and	
Farthings.	96	2·66	72·91		215,040		6*d.*	30 Jan. 1826	
½ do.	192	1·33	36·45		430,080		....	....	Ceylon.
1/10 penny.	240	1·06	29·16		537,600		...	....	Ionian Islands.
⅓ farthing.	288	0·88	24·30		645,120		....	....	Malta.
¼ do.	384	0·66	18·22		860,160		....	....	Ceylon.

The *red* sous of the French currency are copper, nearly pure.

I shall conclude the subject of "material" with a few words on Aurichalchum—or more properly Œrichalchum. The word is a remarkable example of the effect of *sound* in suggesting, first, false etymology, and then false meaning. The barbarism of deriving the term from a combination of the Latin for *gold* with the Greek for *bronze* is obvious enough; but in spite of this the false derivation has been very generally received, and with it the erroneous signification suggested by the spurious etymology. I have stated that the ancients employed many different combinations of metals—bronze being the fundamental constituent, in their works of art. *Aurichalchum* has been supposed to have been one of these into which gold entered in considerable amount. A commentator on Ezra viii. 27—"two vessels of fine copper *precious as gold*"—falls into the mistake, and states that these vessels were composed of "aurichalchum." That these were forms of bronze in which gold was an important ingredient is likely enough; but that orichalchum was *not* one of them is quite clear from Pliny's statement, that in his time the metal was not found, the *mines being exhausted.* The true etymology is οὖρος or ὄρος, a *mountain,* and the true meaning "mountain metal." The exact composition is not known.

I have introduced this metal for the sake of one coin. When the Roman sestertius became equal to 4 ases, its material was changed from *æs* to *orichalchum.*

It is obviously necessary that a medium of exchange should

bear a uniform and established value. In the case of a metallic currency two essentials are requisite—each piece must be of a certain proper *weight* and a certain proper *fineness*. The coin should, if possible, bear upon it some mark significant of its fulfilment of these two conditions. This mark a MINT supplies, as far as the thing can be done. Let a piece of money bear upon its obverse, reverse, and edges evidence of having being struck at some known mint, the degree of probability of its genuineness—that is, of its really containing the amount of metal of proper purity which its denomination professes—depends upon the degree of clearness of that evidence combined with the degree of confidence reposed in the good faith of the managers of the mint.

The *weight* of a fragment of metal may be ascertained by most people with a little trouble: but how great a loss of labor and time would result from having to weigh every piece of money tendered in payment, in the intercourse of modern commercial and social life, is obvious. In England even now, the fact of gold coin being payable by weight not tale is productive of considerable inconvenience. But the ascertainment of the degree of *fineness* of any tendered coin is altogether beyond the reach of the great majority of mankind. Few possess either the chemical knowledge or the chemical skill necessary for "assaying." The evidence afforded by color, lustre, hardness, and "ring"—the only evidence within reach of the unscientific investigator—goes but a little way. For this purpose an establishment of known respectability and unsuspected honesty was necessary; and these conditions seemed best fulfilled by assigning the management or superintendence of the coinage to the State. Confidence in the ruling power in this respect has often been grievously misplaced, as we shall see; but on the whole the arrangement appears the best that can be adopted, and is in modern times the only one.

I need scarcely observe upon the importance of securing the utmost possible genuineness in a country's currency. The Athenians, from whose institutions the Roman jurisprudence was copied, and on which, through the Romans, much of our own and the Continental law is based, punished adulteration of the coinage with death. Until recently in England "coining" and forgery

(a kindred crime) were capital offences. However, this fact is perhaps to be considered rather a part of the revoltingly bloody criminal code of England at the period to which I refer, than as a recognition of the principle that the more thoroughly commercial a nation is—the more numerous and frequent its pecuniary transactions, both in internal trade and external commerce—the more scrupulously pure should the medium of exchange be preserved, and the more severely punished every act likely to create distrust of the country's probity. In the case of the Athenians too it is probable that the national vanity had much to do with the severity of their law against the manufacturers of spurious coin. I have already stated that the Athenians were very proud of the purity of their currency. In proportion to this, pride would naturally be their resentment at any act calculated to diminish the superiority upon which it was founded.

How far the central government of Attica retained the exclusive privilege of coining is unknown. It is certain that some Attic demes coined, though probably under the superintendence of the government at Athens.

Amongst the ROMANS, it was not until a late period under the Empire that the coinage became the exclusive privilege of the governing power. Under the Republic, though the State held the management of the Mint, any family *(gens)* or any individual was entitled to bring gold or silver, and have it coined at the public expense. There seems to have been no attempt at ascertaining the fineness of the metal thus brought to be converted into coin; but it is remarkable that so long as the State acted honestly, as far as the quality of its currency went, individuals followed the example. It was not till after 90 B. C. when government debased its silver by the admixture of one-eighth copper, that individuals imitated the profitable fraud and adulterated their own metal. The evil proceeded to an alarming extent. In 86 B. C. no person knew whether the money he held was false or not. At this time the prætor, M. Marius Gratidianus, is said to have discovered a method of testing the genuineness of the silver coin. His process is not known.

Augustus assumed the privilege of exclusively coining gold

and silver, leaving æs to the Senate. This body retained the remnant of their mint powers until the time of Gallienus, when the complete control of the entire currency of the Empire was monopolised by the Emperor. There were at this time subordinate mints in Spain, Gaul and other parts of the Empire, but the coin struck was Roman. In the western countries the issue of other coins than the Roman was given up in the first century of the Christian Era ; in the East the Roman coin did not become the sole currency until the time of Gallienus.

The earliest coins were *cast*. We have many specimens of Roman pieces of money with marks at the edge where they were separated from the remainder of the cast. In one case in the British Museum there are several Roman *ases* still joined together. The next step was to cast the piece first and strike it afterwards. While this was the usual process, coins of the same denomination and value might vary a good deal in breadth and thickness ; and in many extant specimens of the more ancient coins we find this to be the case. In the present day the dies for striking coin are made of steel, tempered by heating to a certain degree and plunging into water cold in an inversely proportional degree. Thus, a dull red heat and water at 34° (Fahrenheit)—cherry red heat and water at 50°—orange red and water at 80° all effect about the same amount of tempering, though a greater degree of real hardness is produced by the use of cold than of warm water. A red heat and water at 45° of Fahrenheit form the most desirable combination of means for hardening coining-dies.

From what I have said above, it is evident that the most important duty of a Mint is the examination into the fineness of gold and silver about to be converted into current coin. The process is technically called " assaying."

In the English Mint, the assay of both silver and gold is performed by cupellation ; in the French Mint the latter only. The quantity of metal upon which the testing experiment is performed is very small, but is called the " assay pound." In the case of gold it is divided into 24 carats,* and each carat into 4 carat

* $\frac{1}{8}$ carat gr. = $7\frac{1}{2}$ grs. Troy. The weight of diamonds is estimated in carats, carat grains, eighths, sixteenths and thirty-seconds. About 150 carats make a Troy ounce, or 480 grains. *(Brande.)*

grains, quarters and eighths. The silver assay pound is divided into 12 ounces, and each ounce into dwts. and half-dwts.

In the French Mint silver is assayed "par voie humide." The specimen is dissolved in nitric acid, and the silver precipitated in the form of insoluble chloride by a standard solution of chloride of sodium. From the precipitate the amount of pure silver present in a given weight of the subject of experiment is easily found. The presence of a little mercury impairs the accuracy of the result—chloride of mercury, the result of decomposition of some of the chloride of sodium, being also precipitated. However, the existence of an appreciable quantity of mercury in the alloy is known by the solution in nitric acid not becoming clearer when shaken; and by the first deposit of chloride of silver not blackening under the influence of light. The addition of acitate of soda to the solution prevents the precipitation of the mercury. This method is with proper precautions more accurate than the English; but too complex for an establishment where many assays have to be made daily.

An alloy of gold, silver, and copper may be analysed (if silver be present in sufficient quantity) by dissolving the two latter metals in nitric acid. The gold falls in a black powder and may be fused into a button. The silver is then precipitated from the compound solution by chloride of sodium or hydrochloric acid, and the copper by iron. The *assay* of gold is more complicated than that of silver, as it has first to undergo cupellation and then the separation of the silver by nitric acid.

An important subject connected with mint regulations is SEIGNORAGE—the duty sometimes paid to the State upon the conversion of gold and silver bullion into coin.

It is evident that a charge of this kind, whether only equivalent to the actual expense of coinage, or in excess of this so as to afford a revenue, adds to the value of the coin. The value of a piece of money as of any other manufactured article is made up of that of the raw material and the cost of manufacture. If there is no seignorage, then, the coin passes for *less* than its real value. The stamping in the mint adds to the value of the bullion as "the fashion to plate"—to use Adam Smith's illustration; with this

difference, however, that the "fashion" of the plate wlll probably enhance the value of the constituent metal in other countries besides the place of manufacture; while the coin of any country is abroad, only equal to its weight of bullion.

So early as 1691, the question of a seignorage seems to have attracted some attention. In that year a pamphlet appeared from the pen of Sir Dudley North, containing some very sound views upon this and other politico-economical subjects. This Tract, notwithstanding its intrinsic merits, was never very widely circulated and was soon suppressed. The author says that "the free coynage [in England] is a perpetual motion found out, whereby to melt and coyn without ceasing, and so to feed goldsmiths and coyners at the public charge." Many years after this Adam Smith recommended the imposition of a seignorage as the best means of preventing the melting down of coin and of ensuring its return to the country if exported. It is clear that if gold coin were dearer than the same weight of bullion of standard purity, there would be no temptation to melt it down. Again, being *money* at home only, abroad it would be as completely *bullion* as in a goldsmith's crucible. He remarks that even without a seignorage, gold coin is a little dearer than gold bullion, because thrown into a more convenient form, and on account of the delay in the Mint—the interval between bringing the metal to be converted into coin and receiving it transformed. But this enhancement of value is very trifling, and necessarily fluctuates with the amount of business waiting to be transacted in the Mint. He states that if gold coin ever cease to be payable by weight—a system from its inconvenience likely to be abandoned—a seignorage is the only means of preventing the destruction and exportation of the best and heaviest coins. Previously to what he calls the "late reformation" of the currency, the gold coin was more than two per cent. below standard weight. Consequently the current market price of gold bullion instead of being £46-14-6—the mint price—was £47-14-0 and sometimes £48. Newly made coins would not purchase more of anything than the old worn coins—the former were therefore melted down and sold to the Bank as bullion, at a considerable profit to the melters and a considerable loss to the Bank, who could not understand the

constant disappearance of the newest and best part of the currency. A seignorage imposed upon the new coin equal to or greater than the depreciation of the old ones below standard would have equalised their value and prevented the destruction of the former.

I cannot see, however, how a seignorage would prevent exportation if there were a demand for gold or silver abroad. I shall not bring forward the present drain of silver from France as an instance of the inefficacy of this duty to retain coin in a country, because in France the seignorage is a mere trifle. But it seems to me that the artificial enhancement of value of the gold currency effected either by seignorage or by direct legislative enactment, would only produce a universal rise of (nominal) prices. An ounce of gold—coin or bullion—is now worth £3-17-10½. A seignorage of 5 per cent. (suppose) would raise the value of an ounce of gold coin to about £4. But this £4 would only purchase the same quantity of goods—would be equivalent to the same amount of labour only—as the £3-17-10½ was before. A merchant wishing to supply some foreign demand for gold could purchase as much as he pleased at the same rate as before the imposition of the seignorage. We have an instance which appears to me a parallel case; and where the ostensible reason for legislative interference in depreciating the value of the metallic currency was the very object we are examining—the prevention of its exportation. The State of Pensylvania ordered by Act of Assembly that 5*s*. sterling should pass in the colony for 6*s*. 3*d*.; and afterwards for 6*s*. 8*d*. It was supposed that this would make the same quantity of metal more valuable in the colony than in England, and so retain it in the former. The only effect was a universal rise of prices proportionate to the nominal rise of the value of the currency.

One of Adam Smith's arguments in favor of a seignorage is well worthy of attention in these days when so much is said about 'retrenchment'—though so little done. He not only enumerates the coinage amongst those duties of the State which could or should pay their own expenses, but he is of opinion that it should do more; that in England as in some

other countries it should not only maintain itself but also yield a revenue. A seignorage is in one respect, as he remarks, a unique tax. Other indirect taxes are advanced by manufacturers or importers but finally paid by the consumers. The tax on coined money is advanced by every one who receives it but finally paid by none. In his time Parliament allowed £14,000 a year for coinage expenses. Even the saving of this comparatively small sum is not unworthy of consideration.

A law passed in the reign of Charles II. for the encouragement of a coinage made it free for a limited period. This was extended by successive enactments until 1769 when it was made perpetual. Most probably Adam Smith is right in his suspicion, that this was a job for the Bank of England. Her interest is chiefly concerned as she coins most; and her wealth and close connexion with Government in monetary affairs give her sufficient influence to effect a considerable saving to her own revenues at the public cost.

In 1816, as I have before had occasion to mention, a seignorage was imposed upon the coinage of silver. A pound of standard silver is coined into 66 shillings, while the mint price is only 62*s.*, 4*s.* or $6\frac{14}{31}$ per cent. being retained as seignorage. The gold coinage in England continues free.

In 1771, four years before the appearance of the First Edition of the Wealth of Nations, the seignorage in France amounted to $1\frac{4}{15}$ per cent. on gold and $1\frac{7}{24}$ on silver. Adam Smith represents it as much higher, but erroneously. At present the seignorage is insufficient to cover the expense of coinage. It is not more than $\frac{1}{3}$ per cent. on gold and $1\frac{1}{2}$ on silver.

We have seen that all civilised nations at a period of improvement more or less advanced have employed gold and silver—and most of them some third and cheaper metal as the material of their currencies. But in the earlier stages of their civilisation only one metal was used for that purpose; and, as we have seen, silver more generally than gold. The Hebrews, the Greeks, and the peoples who succeeded to the Roman Empire on the European continent employed for many centuries an exclusively silver currency. So the Italian and Roman coinage was exclusively of bronze until a late period. I have pointed out the traces of this

exclusion in the languages of some of the peoples I have named: I wish now to call attention to another particular in which the supremacy of one metal over the others was manifested, after its exclusive employment had given way to the requirements of advancing civilisation and increasing commerce.

One metal has almost always been considered as the sole Standard of Value; and, as a necessary consequence, the sole legal tender to an indefinite amount. The metal which in each particular country had been the first instrument of commercial exchanges has invariably been the first standard of value—and first unrestricted legal tender, and silver having been amongst most peoples the earliest medium of exchange, it has also been most generally the standard of value. In England, for instance, this was the case for a very long time; gold was not a legal tender for many years after it had been introduced into the currency. But as commercial intercourse extended, and as riches increased, men would soon begin to feel that gold is a more convenient metal for large payments than silver; while its value is not more fluctuating—in this country the inconvenience of large payments in a silver currency is often felt. Accordingly in the two great commercial nations of the world gold has supplanted silver as the Standard of Value and as legal tender to an unlimited amount.

But in England and America there was—in France there exists at this present time—an intermediate, transition, state; in which gold *and* silver are the Standard of Value, and gold *or* silver in legal tender to any amount. The English and Americans soon felt the exceeding inconvenience of a Double Standard, and took immediately the obviously necessary steps for their relief. The French are suffering now from the consequences of their attempt to fix by legislative enactment what Nature has made fluctuating—the relative value of the precious metals. But in accordance with the celebrated dictum of the first Napoleon, that "political economy" would crumble to dust the most powerful empire, the French talk of remedies which political economy teaches to be utterly futile, and refuse to adopt the only means which both science and experience point out for the remedy of the evil from which they suffer.

The possibility of maintaining without injury a Double Standard depends upon the possibility of fixing, either once for all or from time to time the relative values of gold and silver. This is simply impracticable. If the relative values depended upon the relative quantities—and if law could prevent the transfer of either from one country to another, the thing might be done. But as I have stated before, the precious metals are so easily smuggled as to render any legislative attempt to limit the supply of either of them ridiculously unsuccessful. I have also stated the negative of the other hypothesis. The relative value of gold and silver depend upon the relative cost of production, the relative amount of labor required to bring them to market. The discovery of a rich and easily worked mine or vein, the invention of an improved pump, the opening for traffic of a new railway, countless other results of accident or ingenuity, may lower the price of silver in a few weeks. Improved machinery for washing alluvium or for crushing auriferous quartz may similarly depreciate gold in every market in the world.

I have collected a few facts illustrative of the fluctuation in the relative values of gold and silver at various periods in the history of mankind.

In II Samuel xxiv. and I Chron. xxi. we have two accounts of the same transaction—the purchase of a threshing-floor by David from Araunah or Ornan. In the former the price is stated in our version to be " fifty shekels of silver"—in the latter " six hundred shekels of gold." The discrepancy may be reconciled by supposing the sum named in Samuel to have been the price of the threshing-floor and oxen only, while the other amount was the value of all the ground about the floor. But if we adopt Bochart's interpretation,* who believes the two sums to be iden-

* He translates the passage in Samuel " David bought the threshing-floor and the oxen *for money (beceseph)* i. e. fifty [golden] shekels." I mentioned before that *ceseph,* properly 'silver' is frequently used for 'money' in general. In the chapter of Chronicles to which these remarks refer (xxi. 24) *beceseph malo* is translated in our version " at its full *price.*" Now turning to the passage in Chronicles, Böchart renders " David gave to Ornan for the place shekels of gold (*shikle zahav) in value six hundred* [vulgar or silver *shekels*] *(mishkall shesh mooth.)*"

tical and reverses the metals, we shall deduce that in David's time gold bore to silver the ratio of 12 : 1. In support of his view he quotes a passage from Plato's Hipparchus (c. vi. p. 231) which gives the same proportion.

Herodotus estimates the relative value at 13 : 1. Menander who flourished about the end of the fourth century B. C. gives the proportion 10 : 1. Livy (xxviii. 11) the same, at about B. C. 189. Suetonius tells us that Julius Cæsar once exchanged gold for silver at the rate of 9 : 1 ;* but under the early Roman Emperors the ratio was about 12 : 1; and from Constantine to Justinian (fourth and fifth centuries) 14 or 15 : 1.

Adam Smith states that when he wrote, the ratio in the European bullion market and in the French and Dutch coin was 14 : 1. But before the discovery of the American mines the ratio in the mints of Europe was 10 or 12 : 1. The American silver mines exceeded the gold mines in fertility; so that while both the precious metals fell in real value, silver fell more than gold—in other words gold rose in nominal value. At present gold costs 14 or 15 times as much labor and expense to bring it to the European market as silver, and *therefore* gold is 14 or 15 times as dear.

These few facts are sufficient to show the unsteadiness of the ratio between the values of gold and silver. Even the fluctuation fluctuates. The relative value of gold has not gone on uniformly increasing, but has sometimes increased, sometimes again diminished. We may expect the present superior fertility of the gold mines of the world to produce the opposite effect to that of the discovery of the American mines in the end of the 16th century, and this will gradually render inefficient even a new adjustment of the Double Standard.

There are two objections to this view: first, that it is contrary to general usage to consider shekels as *golden* when no metal is specified: secondly, that *mishkall* generally (though not always) signifies *weight*, not *value*.

* This passage (Jul. 54) is used to prove that at the date referred to—50 B. C. the change in the silver currency of striking 96 denarii to the pound could not have been introduced; as this would give a ratio of gold to silver 7·8 : 1—which is incredibly low. 84 to the pound gives the 9 : 1 (or rather 8·9 : 1) of the text.

Again, not only are the raw materials of the curreney liable to fluctuation in relative value, but the two groups of coins themselves are subject to unsteadiness in their mutual relation. Coins of smaller value pass through a greater number of hands than the larger denominations—silver coins are more used than gold. The natural depreciation of wear and tear, therefore, will affect the former much more powerfully than the latter. For instance in England in 1695, a guinea was legally worth 21 shillings ; in reality it was equal in value to 30*s.* of the worn and clipt coin then in circulation. Now suppose this state of things to have existed any time between 1774 and 1783, the legal tender of silver during that period being fixed at £25—(and at that time the silver coin *was* very much deteriorated by wear,* though not to so great an extent as I have mentioned above): during those nine years a man who owed £25 would be able to pay it with silver worth £17-10-0. Afterwards, from 1783 to 1798, there was no restriction whatever on the amount to which silver was a legal tender. I cite these facts merely as illustrations of the degree to which the fluctuation in the relative values of the gold and silver currencies may extend, and the consequent evils which would arise from the option of discharging liabilities in either metal. The debtor will of course pay his debts in the cheaper coin: the other, estimated below its real value will be exported by the bullion merchants to countries where it bears a higher price ; and the currency tends to return to its primitive state and to consist of but one of the precious metals.

I shall conclude this subject with a brief account of the failure of the Double Standard System in England, America, and France. In the case of the first and last countries my quotations are taken from a Note by Mr. McCulloch.

" According to the late Lord Liverpool, (*Treatise on Coins*), gold coins passed current at certain rates fixed from time to time by Royal Proclamation,† and have consequently been legal tender

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* In 1811, in the discussions in Parliament upon the Resumption of Cash Payments, it was stated that during the period mentioned in the text £25 would vary from 5 lbs. 5 oz. 15 dwt. of silver to 8 lbs. 15 oz., according as it was paid in the worn sixpences or the new crowns.

† I found accidentally in a newspaper the following variations in the weight of the gold pound in England. In 1558, 174 grs. equal to

from the time gold began to be coined in England, in 1257, till 1664 when the guinea, which was then first coined, and the other gold coins were permitted to pass current, without any valuation according to the relative worth of gold and silver in the market. This practice continued till 1717, when the rate or value at which a guinea should exchange was fixed at 21 shillings. From this period till 1774 gold and silver coins were equally legal tender: but from the circumstance of gold having been overvalued with respect to silver, in the proportion fixed in 1717, almost all large payments were made in gold, silver coins of full weight being exported as soon as they came from the mint, while none but those that were worn and debased remained in circulation. In 1774 it was enacted, that no tender made in silver coin by *tale* should be legal for more than £25—and that any tender for a larger sum in silver must be made by *weight*, at 5*s.* 2*d.* an ounce. And finally, in 1816, the value of silver was raised above its just proportion as compared with gold, by coining 66 shillings instead of 62 out of the pound troy: but in order to prevent this overvalued silver currency from driving the gold currency out of the country, and becoming the sole medium of exchange, it was at the same time enacted that silver should be legal tender to the extent of *forty shillings* only: while to prevent its sinking in value from redundancy, the power to issue it was placed exclusively in the hands of Government. Under these regulations silver has become a merely subordinate species of currency, occupying the same place in relation to gold that copper occupies in relation to itself. This system has been found to answer extremely well. In another Note I find the following passage on the same subject. "This overvaluation" [of gold in the mint regulation, of 1717] "was estimated by the late Lord Liverpool to have been at the time about equal to four pence on the guinea, or to $1\frac{10}{61}$ per cent., and as the real value of silver with respect to gold continued to increase during the greater part of last century. The advantage of paying in gold in preference to silver became more decided; and ultimately led as has been previously observed, to the universal

28*s.* 3*d.* in our present coin: 1601, 171 grs. about 27*s.* 9*d.*: 1604, 154 grs.; 1625, 140 grs.; 1675, 129 grs.; 1815, 123 grs. nearly, as at present.

use of gold in large payments, and to the exportation of all silver coins of full weight.*

In the United States of America after the discovery of the Californian gold-fields, the same evil was felt, the same remedy adopted, and with the same success. Gold becoming more abundant fell in real value ; while its nominal value fixed by law, the amount of silver to which it was equivalent, remained unchanged. All large sums were paid in gold, relatively the cheaper metal, and the silver coin was rapidly disappearing, exported at a profit. Change of a 5-dollar piece in silver could scarcely be obtained anywhere. The U. S. silver dollar contained $412\frac{1}{2}$ grs. In 1853 Government gave up coining *silver* dollars altogether, and reduced the weight of the half-dollar piece to 192 grs. At the same time silver was made a legal tender only to the amount of Sp. drs. 5. Before this change the ounce of silver was worth $116\frac{4}{11}$ cents, now it is worth 125 cents, or $1\frac{1}{4}$ dollars. Since that time the intrinsic value of silver has risen as high as $123\frac{3}{4}$ cents, showing that it is scarcely sufficiently overvalued, and that a re-adjustment may be necessary at no very distant date.

In France at present the same inconvenience is severely felt. Our pity must be diminished by the fact that this is the second time the French system of a Double Standard has been attended with unpleasant consequences. Experience seems to have lost in France, the didactic powers attributed to her in our Latin Grammar. On the former occasion it was the silver that was overvalued and the slighted gold that left the country ; and from what I have said about the more frequent circulation of silver coin than of golden, the present deficiency of silver currency must be a far greater inconvenience than the former exportation of gold. " In France previously to the re-coinage in 1785, the louis-d'or was rated in the mint proportion at only 24 livres, when it was really worth 25 liv. 10 sols. Those therefore who should have discharged the obligations they had contracted by payments of gold rather than of silver, would plainly have lost 1 liv. 10 sols. on every sum of 24 livres. The consequence was that very few such payments

* The present system of overvaluing silver and fixing a superior limit of legal tender was proposed by Adam Smith in the Wealth of Nations.

were made; that gold was merely banished from circulation; and that silver became almost the only species of metallic currency used in France."

For ordinary numeration, the DECIMAL system of notation is, so far as I am aware, universal. The number of the fingers—the arithmetical instruments of the uncivilised and the school-boy, so obviously suggests TEN as a basis of notation that we cannot be surprised at its universal adoption. In one respect TWELVE offers superior advantages—it has *four* measures while ten has only *two*—but though it is possible that this consideration may have had some influence in affecting the Roman division of weights and measures, TEN has gained the victory in the usage of mankind as the basis of merely numerical notation.

From this prevalence of a decimal notation one might be led *a priori* to infer the adoption, in some countries at least, of a decimal system of weights and coinage: but this seems altogether a modern refinement, and even now its advantages are not sufficiently recognised to enforce its adoption. It would be incredible that the number *ten* should not occasionally enter into monetary Tables, but it does so (with two modern exceptions) more by accident than design, at least its introduction, if caused by a perception of its convenience, is only secondary and subordinate to the original and primary division. Take for an example the Roman measures of *length*. The foot (pes) was divided into *twelve* inches, and *sixteen* fingers (digits): but *five* feet made a pace *(passus)* and *one thousand* paces a Roman mile.

Measures of length do not belong to my present subject. I shall only remark that their divisions would naturally be suggested by the ordinary proportions of the human frame, as we know the Hebrew, Greek, and Roman principally were, and consequently a decimal system was scarcely to be expected.

The nations of antiquity seem to have attached peculiar importance to some certain number, selected for reasons proper to each country, and therefore different in each. Common to all the human race, as I have said, is the pre-eminence of the number TEN. FIVE may be added as similarly suggested; and the relation between these, or rather the relation of two *hands* to one, or the

duplication of the principal organs of the human frame, naturally gives importance to the number TWO. These elements very probably entered into the system of weights of all nations in the earliest stages of civilisation, and, as I have remarked before, the original coins were only weights. Depreciation in coinage might afterwards alter the numerical relations between the denominations, and these disturbances might or might not extend to the weights with which the coins were originally synonymous. If they did so extend, this would be one cause of the impossibility of now finding traces of the original basal numbers in the divisions that have come down to us. Another element of change might be the relative value of gold and silver; this ratio might not be expressed by any of the numbers I have alluded to, and yet might in some way enter into the system of monetary division. Other circumstances might be brought forward to account for the occasional absence of any apparent law of division in ancient or modern systems of currency, I shall just state briefly in illustration of these remarks, some facts connected with Hebrew, Greek and Roman systems of monetary division.

Amongst the HEBREWS for obvious reasons, *twelve* was a leading number.* *Six*, or the multiple of six and twelve, appears in the *seventy-two* selected for the translation of the Hebrew Scriptures into Greek, commonly, for shortness, called " the LXX." Both these numbers, 12 and 72 were retained in the foundation of the Christian Church. A glance at the Table of Jewish weights (and coins) will show the prevalence of the national number combined with *ten* and *five*.

Gerah.				
10	Bekah.			
20	2	Shekel.		
1,200	120	60	Maneh.	
60,000	6,000	3,000	50	Talent.

I am not aware of these Hebrew weights having undergone any

* SEVEN also was a number of great mystical sacredness, but it does not seem to have entered into their system of weights.

alteration. They probably disappeared along with Jewish independence. Under Roman sway Roman currency circulated—the fact is expressly cited in the New Testament as an obvious proof of the extinction of Jewish liberty. The theocratic institutions of the people (for the theocratic element was not altogether extinguished by the adoption of kingly government) had probably much to do with the freedom of their coin from fraudulent depreciation, and thus one cause of disturbance of the relative proportions of their weights was avoided. The standard shekel was preserved *in the sanctuary.* It was probably in imitation of this custom that Justinian ordered the standard weights and measures to be kept in the principal *church* of each town, without, I fear, a similar result. The attachment of the Jews to their national customs, peculiarities, and prejudices also contributed to the preservation of their system of weights unchanged, so long as their power corresponded to their will.

I have only to add that a passage in the book of Ezekiel (xlv. 12)—" twenty shekels, twenty-five shekels, fifteen shekels shall be your maneh"—implies the existence of coins of those values respectively, all multiples of *five*, and all together making 60 shekels, or one *maneh* or *minah*, the maneh itself being a multiple of 12 and 5 shekels.

In the States of GREECE, I have already said, several standards were in use; but the relation between the four denominations of their systems of weights and coins remained constant in all. The Table was—

Obolus.			
6	Drachma.		
600	100	Mina.	
36,000	6,000	60	Talent.

In this system *six* and *ten* are the multiple numbers: the former may have come from the Hebrew division; the connection between the two Tables being shown by the evident identity of the *minah* ($\mu\nu\hat{a}$) and *maneh*. But *twelve* seems to have been a

favorite number amongst the Greeks as well as the Jews. Cecrops, for instance, divided Attica into *twelve* districts.

The ROMAN system of coinage was duodecimal, the AS was divided into *twelve* parts. But into this system also the number *ten* entered. When silver began to be coined, the denarius was equal to ten ases: 1,000 sestertii (each of which was originally equal to two ases and a half) made the *sum* "*(sestertium)*," in which large amounts of money were counted. What led the Romans to a duodecimal system I cannot say. The numbers which appear prominently in their traditions and institutions are 3, 10, and their multiple 30; but 12 is the basis of the divisions both of weights and measures of extension.

In England, one of the two greatest commercial empires in the world, the introduction of a decimal system of coinage would be so obvious an improvement, that one not acquainted with the "manners and customs" of the people would be disposed to believe that the mere proposal of such a measure would be immediately followed by its adoption. But he is a sanguine man who expects that he will live to see a Decimal Coinage in England. A century of Parliamentary debates and Select Committees must pass away; and then our great grand-children may perhaps enjoy facilities in the working of sums in Compound Division, which their ancestors only talked of. *We* must be content with the coinage of the florin, improvement enough for half a century at least. In England reform is very slow, and I cannot help thinking that in the matter we are now considering, there is a latent unwillingness in the national mind to adopt even an improvement as yet peculiar to America and France.

DEPRECIATION of currency may be unavoidable—the natural result of the wear and tear of the material by constant use, assisted by "clipping," "sweating" and other industrial efforts of fraudulent individuals. In England, in the reign of William III. the gold and silver coin contained 30 per cent. less of the precious metals than they professed. This was principally due to wear and was remedied by the re-coinage of 1773. Since then the evil has been little felt, although the silver currency at least has been at times in a very worn state. At present the gold coinage is a

legal tender by weight only, the light pieces are withheld from circulation by the Bank of England.* By this means the gold currency is kept up to its proper standard of weight. The silver coins bear only a conventional value higher than the intrinsic; their depreciation by wear therefore is of little consequence.

This last remark leads me to mention again a species of Depreciation by design. I allude to the overrating of the silver coinage in England and America. This *is* a depreciation—the coins are not worth the value they represent. But its object and its result are public convenience. Its motive is very different from that of the Depreciations by design to which I now proceed.

Wherever there has been a coinage there have been fraudulent depreciations by the governing power. "In every country of the world, I believe," says Adam Smith, "the avarice and injustice of princes and sovereign states, abusing the confidence of their subjects, have, by degrees diminished the real quantity of metal which had been originally contained in their coins." In another place he quaintly writes, "Princes and sovereign states have frequently fancied that they had a temporary interest to diminish the quantity of pure metal contained in their coin, but they seldom have fancied that they had any to augment it." In days when the identity of interest of the governors and the governed was little understood or recognised, interference with the coinage seemed a very easy and effectual method of getting rid of an importunate state creditor. It was the "most usual expedient for disguising real bankruptcy under appearance of payment."

In Sir Dudley North's Tract (1691), from which I have quoted before on the subject of seignorage, it is laid down that "debasing the coyn is defrauding one another, and to the public there is no sort of advantage in it: for that admits no character or value but intrinsic:" and that "the sinking by alloy or weight is all one." These principles have, with few exceptions, prevailed in practice ever since. Perhaps the barefaced depreciation by James II., who in Ireland struck pieces of gun-metal of the same size as

* The number of these so withheld is, I believe, very considerable but appears to be kept a profound secret, at least I have seen it so stated.

the current silver coins, and ordered that they should pass as silver, may, with its complete failure in its object, have done more to inculcate sound economical views on this subject than any number of volumes.*

Fraudulent interference with the standard of the coin may be directed to reduction of the weight (in other words, raising the denomination) or to adulteration of the material: or both these may be combined, as was done in England in the end of Henry VIII. and beginning of Edward VI., and in Scotland during the minority of James VI. The first plan is of course open and avowed. The second admits of some attempt at concealment and probably escapes discovery for some time.† But when the secret does ooze out the public indignation is considerably more violent than is ever excited by the raising of the denomination. This is easily accounted for. When the weight of the coin is diminished, the individual and the Government "start fair." The private debtor pays his debts on as favorable terms as the public. In the other case the Government has the advantage of the interval between the adulteration and its discovery. I may observe that this greater degree of public indignation produces one very important effect—the standard of purity is almost sure to be restored, the standard of weight seldom or never.

Athens and Rome furnish us with examples of qualitative depreciation. Both cases to which I allude have been mentioned before. The Athenians, in 407 B. C., issued a debased gold currency. The Roman Republic, about 90 B. C., adulterated its silver coinage; the example was followed by private individuals, and the evil reached a considerable height. In both these cases, purity of standard was restored; the Roman currency was reformed—the Athenians recalled their debased gold.

We must not suppose that depreciations have always been due to the "avarice and injustice of princes and sovereign states."

* Yet we find Mr. Lowndes and a large minority of the House of Commons at the time of the re-coinage in William III., proposing to degrade the standard of British coinage. Their proposal was rejected, chiefly owing to the influence of John Locke's writings.

† King John of France swore the mint people to secrecy when he tampered with the material of the coinage.

Interference with the currency has sometimes been dictated by the distress of large numbers of *subjects*. In ancient times especially, the extent of debt and the severity of the law, (when the creditors were also the law makers) rendered relief, complete or partial, of debtors a necessary preliminary to any constitutional reform. No improved system of government could be stable, while the mass of the people was plunged in hopeless pauperism and inextricable debt. While the constitution remained unchanged, habit and the conservative principle which exists to a greater or less degree in every people might preserve the impoverished masses from taking the law into their own hands, and relieving themselves simultaneously of their creditors and their debts. But a wise legislator or reformer proposing to himself to effect extensive alterations in the Constitution of a State, would not risk the downfall of his newly-raised political structure, the supervention of utter anarchy, by leaving large numbers of the people in hopeless misery; while his very improvements broke their habit of submission to government, and impaired the conservative principle by the exhibition of important and perhaps sweeping reforms. The example of change would soon be followed by thousands actuated not by enlightened political views, but by the pressure of want and the prospect of enfranchisement from their hopeless pecuniary thraldom.

Accordingly the great Athenian legislator commenced his political reforms by the relief of debtors. This he effected by a quantitative depreciation. He coined into 100 drachmæ the weight of silver which had previously made 73. This is so unlikely a number to have been selected that we are justified in believing that Solon intended to reduce debts by a *quarter*, and that 73 was an accidental substitution in the mint for 75. The mistake was not corrected; and even the Macedonian gold coin which was struck after the Athenian standard retained the Athenian error.

After the time of Alexander the Great, the drachma—the Greek standard coin underwent the ordinary kind of depreciation. The weight was reduced from 66·5 grains to 63.

The first depreciation in the ROMAN coin was effected by the State shortly after the commencement of the First Punic War.

The *as* which had hitherto been a pound of bronze was reduced to the weight of the sextans—its sixth part. By this ingenious contrivance the Republic paid " 3*s*. 4*d*. in the pound" under the appearance of a complete discharge of its liabilities. Again, in the second a further reduction to *one ounce* was made. At the same time the denarius which had originally been equal to ten ases was decreed to be henceforth equivalent to *sixteen :* with an important exception in favor of the soldiery. In their pay the denarius was to retain its original ratio to the as. Soon after this, about 191 B. C. a law was passed reducing the weight of the *as* to half an ounce.

These three changes are reported by Pliny; but there mnst have been several others both intermediate and subsequent. We possess ases weighing $\frac{1}{48}$, and even $\frac{1}{60}$, of a pound; and others representing intervening depreciations and weighing 11, 10, 9, 8, 3, $1\frac{3}{4}$ and $1\frac{1}{2}$ oz. These successive reductions do not seem to have created any disturbance or even excited opposition. It is probable that the measures were proposed by some popular man and easily carried through the popular assembly. The poorer classes in Rome, and especially the soldiery, were heavily involved in debt. None of them were state-creditors except the soldiers, and their interests were, as we have seen, not neglected. It mattered little to the majority in the popular comitia how the State defrauded its creditors, while they could with equal ease discharge, or at any rate diminish their own obligations.

I must not, however, omit to mention that the Marquis Garnier asserts that the changes in the value of the *as* were introduced, not with fraudulent intention, but in order to adjust in the Roman currency the relative values of bronze and silver. To this statement Pliny's account of the transactions in question is explicitly opposed. He expressly states that the depreciations were effected by the Republic for the discharge of her debts. Further, had the reduction of the weight been gradual, the work of successive ages, as M. Garnier's theory would require, the coins would exhibit in their style of execution differences corresponding to the differences in their value. All the various pieces, however, which I have enumerated above, are evidently of the same or very nearly the same date.

The Roman gold coinage was depreciated one-half (or nearly) between its first introduction and the time of Constantine the Great. Pliny tells us of 40 *aurei* to the lb., and under Nero (the reading of this passage is doubtful) of 45 to the lb. This change was most probably made under Julius Cæsar. It reduced the standard weight of the aureus from 130·1 grains to 115·64.* Constantine struck 72 from the pound of gold,† and this continued to be the standard to the end of the Empire.

It would be tedious in the extreme, and uninteresting moreover, to trace the progress of depreciation in the principal countries of Europe. Sir Boyle Roche is said to have moved in the Irish House of Commons "that every quart bottle should hold a quart." A universal ordinance "that every pound should be a pound" would produce a wonderful revolution in the commercial world. "The English pound and penny contain one-third, the Scots one-thirty-sixth, the French one-sixty-sixth of their original values." The currency of every country tells a similar tale.

I shall conclude this paper with a few historical facts connected with the Drain of the precious metals to the East. I shall be as brief as I can: I have already exceeded due limits.

Gold and silver have always been advantageous articles of export from the West to the East. Perhaps this proposition should be otherwise stated; the East has always produced in abundance necessaries and luxuries which the West has ever been willing to import and pay for, while many circumstances have combined to render payment in the precious metals more acceptable than payment in goods, or at least to establish a preponderance of imports of commodities other than gold and silver over exports, leaving the balance of course to be discharged in the universal medium of exchange. In the jargon of the Mercantile system, and in reference to this subject neither its language nor its theories are yet quite exploded; the "balance of trade" has almost invariably

* There are no specimens of aurei extant weighing so much as 130·1 grains. The heaviest known is one of Pompey's and weighs 128·2 grs. The average gold coins of Julius Cæsar weigh 125·66 grs.—of Nero, 115·39 grs. The aurei of Augustus in the British Museum average 121·26 grs.

† This would make the weight of each aureus 72·28 grs.

from a very early period been against the West and in favor of the East. Time will not permit me to enter into a full examination of the causes which have led to this result. I shall simply touch upon one or two.

The inexhaustible fertility of the soil of many Eastern countries and the variety of its useful products have been one cause. Densely peopled as the East is, its soil has ever produced far greater quantities both of food and of other articles of commerce than are sufficient for the requirements of its population. While exportation of this surplus produce was the necessary consequence of its existence, climate and a low state of civilisation combined to restrict the wants of the people. There was little demand for the productions either raw or manufactured of other countries where among all classes, tastes were simple, comforts little known, and the conservative principle strong, the poor required little clothing and little shelter. Even the magnificence of the rich was simple and demanded little beyond gold, silver and gems. What I have said will account for the preference of the precious metals to other articles of import; but other circumstances produced a positive demand. For example, the love of ornament of semi-civilised peoples. Again, the insecurity of property in a country like India, divided into numerous petty states independent of each other and often hostile; while the moral principle, according to our ideas, is not very strong—gave a tendency not only to hoarding but to keeping property as much as possible in a portable and easily concealable form. For this purpose gold and silver rank next to precious stones. Again, an extensive internal trade demands large supplies of a precious metal for a circulating medium. This refers more especially to China, whose internal traffic is enormous. But she has never drawn such quantities of the precious metals from Europe as India. Her own internal supplies of silver are very large, so much so that for about twenty years previous to 1851, she not only absorbed no silver but exported nearly £2,000,000 annually.

I must content myself with thus briefly adverting to a few of the causes of the Drain.

I have spoken of the precious metals generally but silver has always been preferred to gold. The former is the great material

of Eastern currencies: and the relative superiority in value of gold has consequently always been much lower in the East than in Europe. While the ratio in Europe is about 15 : 1, in the East it is 10 (or at most 12) : 1. Adam Smith states that in his time, while in the Calcutta Mint (as in England) the proportion was 15 : 1, in China it was 10 : 1 and in Japan 8 : 1. Of course under these circumstances it is more profitable to bring silver to the East than gold; and accordingly the former has always immensely preponderated in the imports. This preponderance has been so marked that Mr. Meggens, an authority of considerable weight in politico-economical question, and more than once quoted by Smith, accounted for the difference between the ratio of the values of gold and silver in the European market and that of the quantities brought into Europe, by pointing to the large exports of silver to the East. The proportion of the silver brought annually from America to the gold was 22 : 1—while the relative values of the metals were as 14 (or 15) : 1. I have said enough in a former part of this paper to render it unnecessary now to dwell upon Mr. Meggens' mistake. I have mentioned him here only to show the great preponderance of silver over gold, in exports to the East in his time.

The complaint that the East was taking gold and silver from Europe is as old as Pliny's time. He mentions (*Nat. Hist. lib.* xii. *cap.* 18) the silks, spices, &c. imported into Italy from the East, and adds—"Minimâque computatione millies centena millia sestertiûm, annis omnibus, INDIA et SERES peninsulaque illa [Arabia] imperio nostro demunt." In 1600, when the East India Company obtained their Charter, the importance of gold and silver as articles of export to the East was so well known that that body obtained leave to convey eastwards annually £30,000 worth of foreign coin or bullion. The Mercantile System was at that time so powerful that this permission was saddled with a condition that within six months of the termination of every voyage, the Company should re-import into England an amount of gold and silver equal to the quantity of silver exported.

From the time of the discovery of the American mines until the revolutionary disturbances to which I have before referred, the

drain of silver to the East continued steadily to increase. Humboldt states that of the Sp. drs. 43,500,000 worth of gold and silver annually brought to Europe from America before the Revolutions, Sp. drs. 25,500,000 went to Asia—4 millions by the Levant, 17½ round the Cape, and 4 through Russia. McCulloch says that in 1851 the drain had ceased, and Asia was even exporting silver; but I think this can only have been true of China. *Now*, at any rate, large quantities of silver are imported into India and China. I shall quote a recent article in the *Daily News*, (*July* 4,) to show the present state of the "Balance of Trade" between Europe and Asia.

"As it is certain that the Money Market has of late been greatly affected by the flow of silver to the East, it may be useful to glance at the statistics of this movement for the six months terminating on the 30th June, 1857. The subjoined table exhibits the aggregate shipments from Southampton by each fortnightly packet:

	Gold.	Silver.	Total.
Jan. 4	£2,091	£428,105	£430,196
,, 20	7,882	359,445	367,327
Feb. 4	18,388	952,940	971,328
,, 20	6,775	670,340	677,115
Mar. 4	8,231	783,929	792,160
,, 20	11,255	776,332	787,587
Apr. 4	7,998	780,686	788,684
,, 20	11,777	733,188	744,965
May 4	2,460	548,691	551,151
,, 20	2,128	748,943	751,071
June 4	5,314	756,299	761,613
,, 20	2,145	1,140,471	1,142,616
Total	£86,444	£8,679,369	£8,765,813

"Our table proves how essentially this is a silver movement, for the remittances in gold have amounted to scarcely one-hundredth part of the total. Supposing that the shipments in the second half of 1857 be equal to those of the first half, the drain will have assumed the astonishing proportions of seventeen millions and a half sterling per annum, without taking into account the considerable

additional sums despatched by way of Marseilles. Nor, judging merely from the figures before us, does the drain present any signs of slackening; for, while the exports in the first quarter of 1857 were £4,025,713, or at the rate of £16,102,852 per annum, those in the second quarter reached £4,740,100, or at the rate of £18,960,400 per annum. Last year the magnitude of the shipments of silver eastwards excited general remark, yet in the first six months of 1856, the total was not more than £5,100,633, being £3,665,180 less than in the corresponding period of the present year. In the corresponding six months of 1855, the aggregate amount was only £2,514,806. The increase is especially conspicuous in the remittances to China, which in the months now ended, has absorbed £2,726,786, against only £937,288 in the corresponding period of last year. These figures refer to China Proper. The other regions of the East have this year taken £6,039,027, against £4,163,345 at the same date last year. Finally, in order to give the clearest possible idea of the rapidity of the general movement, we will summarise the aggregate figures for the last seven years, viz.:—The total remittances from England to the East were:

In the whole of 1851	£1,818,380
,, ,, 1852	3,551,977
,, ,, 1853	5,590,867
,, ,, 1854	4,306,302
,, ,, 1855	7,358,161
,, ,, 1856	12,118,985

In the first six months of 1857, £8,765,813, or at the rate for the year of 17,531,626.

" The first question that naturally suggests itself when figures of this magnitude are adduced is, whence are such enormous quantities of silver derived? The answer is readily supplied. Great Britain, we know, does not supply them out of her stock of silver, for enormous though the amount of silver coinage doubtless is, each piece of British silver money is merely a token, and worth, at the current price of silver considerably less than the sum which it professes to represent. But a different system prevails on the Continent, whence, accordingly the Eastern demand for silver is

mainly satified. From a statement which we have compiled with care, we find that the imports of silver into England by the Royal Mail Company's Packets from the West Indies, Mexico, and the Isthmus, have amounted this year to about £2,250,000 sterling. Adding an estimated total of say half a million in silver drawn from other Trans-Atlantic sources, we arrive at a total supply of about two millions and three-quarters derived from other than Continental States. The shipments of silver alone, direct from Southampton, having amounted in the first six months of 1857, as already stated to £8,679,369, it follows that nearly six millions sterling in silver must have been drawn from the stocks of that metal, either held by the banks on the Continent or circulating as coin there. In all probability, and especially judging from the immense quantities of French and Belgian five-franc pieces which are despatched just as they are received from the Continent, or is chiefly upon the actual stock of Continental coinage that this serious and never-ceasing draught is made.

"French official returns recently published throw a striking light upon this remarkable movement. During the first five months of the present year, the exports of silver from France exceeded the imports of that metal by about £5,900,000. These exports were doubtless chiefly to England, and in this single fact we have evidence as to the source from which is drawn the rest of the needful supplies of silver over and above those received from America. Nor is this wholesale abstraction of silver from the Continent a temporary or evanescent process; it has gone on for years, in a constantly increasing ratio, and bids fair to continue so long as silver can be procured there, and is wanted in the East. In 1854 the silver exported from France exceeded the imports by £6,548,000: in 1855 by £7,888,000, and in 1856 by £11,344,600, making a total drain of £25,780,000 in the short space of three years. Of this a portion went to the East, another large portion has been locked up in the National Bank of Vienna,*

* This Bank was established by Maria Theresa in 1762, for the purpose of effecting a *paper* circulation, to which a forced legal currency was given. In 1797, Government prohibited demand of exchange in coin above 25 fl. (£2). During the war gold and silver almost disappeared from circulation and instead there was paper, representing sums as low as 2*s*. or 3*s*. Much of the smaller currency was *brass* and issued at double its intrinsic value.

awaiting the time, as yet apparently remote—when that institution may be in a position to resume cash payments ; and the rest has probably been generally diffused over the Continent or been worked up into various forms. As a matter of course, France received an equivalent, which was chiefly in gold. Indeed, according to the official returns, during the three years referred to, the imports of gold into France exceeded the exports of gold from that country by a total of £36,392,000. Deducting from this sum £25,780,000, being the excess of exports over imports of silver, there remains a balance of £10,612,000, which the French economists seem disposed to regard as constituting a positive addition to the metallic wealth of the nation. As a comparison of the returns of the Bank of France at the beginning and end of this period of three years exhibits a great decline, instead of an increase, in the Bank's stock of bullion, it is clear that the ten millions and a half alluded to has not been absorbed by that establishment. French writers, of an optimist frame of mind, allege that it is circulating in the shape of coin, and facilitating the enlarged commercial transactions of the nation. Other parties are inclined to suspect that the amount in question has been principally hoarded in the interior of the country, this process being stimulated by the sense of political insecurity, which is still unfortunately too rife, and the only legitimate means of obviating which—we mean freedom of polititical discussion, the Government still obstinately rejects.

"It would be hazardous to assert that the drain of silver to the East will prevent a reduction in the value of money, for very possibly this adverse element may be counteracted by other more favorable influences; but it will certainly, if it continue, promote a good demand for money, divest large masses of gold to the Continent, and thus prevent a return to low rates of discount. Viewed in this light, the silver drain deserves the attentive consideration of every one engaged in commercial pursuits."

I have given the article entire, it is ably written, its facts seem to have been carefully collected, and it throws light not only upon the subject with which I have been more immediately concerned, but also upon others previously examined in this paper.

SELECTIONS.

Lecture on the Geology of the Province of Auckland, New Zealand. [Delivered to the Members of the Auckland Mechanics' Institute, June 24, 1859.] By Dr. FERDINAND HOCH-STETTER, *Geologist on board the Austrian frigate "Novara," and Member of the Austrian Scientific Novara Expedition.*

Mr. President, Ladies and Gentlemen.—The members of the Auckland Mechanics' Institute having done me the honor to elect me as honorary member of their institution, and the Committee having invited me to give a Lecture upon the Geology of this Province, I have much pleasure in complying with their request. It is, however, with some hesitation that I undertake this task, fearing that my imperfect knowledge of the English language will prevent my making the short sketch I wish to lay before you as interesting as it might otherwise have been. Notwithstanding this drawback, I am glad to have this opportunity of giving the inhabitants of this Province, through the members of this Institute, such a *résumé* as I can of the chief results of the Geological Survey I have made of those parts of the country I have visited.

I feel this, indeed, to be a duty I owe to the community at large, in return for the very kind reception that has everywhere been given me—for the ready help that has always been afforded by all whom I have met with—and for the interest that has been shown by all in the proceedings of the Imperial Austrian "Novara" Expedition.

Having, in the months of January and February, completed my Survey, and finished a Geological Map, of the Auckland District, which I now have the pleasure of showing you, the necessity arose for my choosing either the *Northern* or the *Southern* portion of the Province for my farther researches, my limited stay in New Zealand rendering it impossible for me to make a sufficient examination in both directions.

I did not hesitate to choose the Southern districts—for these reasons: that the country over which I should there proceed, is

inhabited almost exclusively by Maories, and has hitherto been almost unknown and totally unsurveyed, both topographically and geologically. The Northern districts, on the contrary, are for the most part better known, and from the number of European settlers in them, I was led to hope I should be enabled to collect some information through specimens forwarded to me for examination, and from the verbal descriptions of those who are well acquainted with the various localities.

My hope was not unfounded in either respect.

I have received many specimens of interest from various localities: also some valuable information from different settlers, and especially from my friends, the Rev. A. G. Purchas, and Mr. C. Heaphy, who in the last few months have had opportunities of visiting several parts of the Northern portion of this Province, and of collecting very valuable specimens. In addition to this must be remembered the fact, that other scientific men, especially MM. Dieffenbach and Dana, had already visited and described at length some parts of the Northern country.

Through the liberality and excellent arrangements of the General and Provincial Governments, I have been enabled in a comparatively short time to travel over and to examine the larger portion of the Province South of Auckland, extending as far as Lake Taupo and Tongariro Volcano, the boundaries between this Province and those of Wellington and Hawke's Bay. I have thus obtained materials which will enable me, on my return to Europe, to construct a Topographical and Geological Map of the central part of the Northern Island.

My observations have, with the able assistance of Mr. Drummond Hay, extended from the East to the West Coast; and the numerous peaks and ranges have afforded facilities for fixing, with satisfactory accuracy, by means of *magnetic bearings*, on the basis of points previously fixed by the nautical survey of Capt. Drury, on the Coast-line, all the great natural features of this portion of the country. A great number of *barometrical observations* have afforded me the means of ascertaining the heights of mountains and plains in the interior, which I shall be able to calculate with accuracy by the aid of corresponding daily observations, taken in

Auckland, by Colonel Mould, who has kindly forwarded me a copy of his tables.

I have also obtained *photographic* and other *views* of great interest, many of which were taken by the gentlemen who accompanied me on the expedition for this purpose; and a large number of exceedingly valuable sketches have been contributed by the talented pencil of our President, Mr. C. Heaphy, for future publication in a geological Atlas. Many of these are decorating the walls and others are lying on the table, and I shall be happy to show them to any ladies and gentlemen who may feel an interest in seeing them, at the conclusion of the lecture.

My *collections* have been growing from day to day, and include specimens of great interest in most branches of Natural History. I owe a great deal to the indefatigable zeal of my friend and fellow-traveller, Mr. J. Haast, who assisted me in collecting during our expedition. I am also much indebted to Mr. J. Crawford at Wellington, Mr. A. S. Atkinson of Taranaki, Mr. Triphook of Hawke's Bay, Mr. H. T. Kemp of the Bay of Islands, to the Missionaries, and to almost innumerable friends in Auckland.

Preliminary Remarks.

I cannot suppose that all my audience are acquainted with the first principles of Geology. I shall therefore be under the necessity, in order to make my report intelligible, of prefacing a few remarks upon the chief divisions of the Geological formations.

The various rocks, soils, and minerals, which occur upon the surface of the earth, or at various depths beneath it—in one word, the materials of the "*earth's crust*"—are classified, in the first place, with reference to their different *origin*, or, in other words, with reference to the different circumstances and causes by which they have been produced. They are divided into *four* great classes —*Plutonic*, *Metamorphic*, *Aqueous*, and *Volcanic* rocks. Another mode of classification is with reference to their *age*—that is, to the comparative periods of their formation. Those divisions will be easily understood.

The *Plutonic* rocks comprehend all the *granites*, *syenites*, *porphyries*, *diorites*—rocks which agree in being highly crystalline, unstratified, and destitute of organic remains—which are consi-

dered as of igneous origin, formed in the earliest periods of the earth, in great depths, and cooled and crystalized slowly under great pressure.

The *Metamorphic* rocks are the crystalline strata, or schists, called *gneiss*, *mica-schist* or *mica-slate*, *chlorite-schist*, *hornblende-schist*—also destitute of organic remains. According to the most probable theory, these strata were originally deposited from water in the usual form of sediment, but were subsequently altered by subterranean heat, so as to assume a new texture.

The two first classes of rocks are usually found in such a position that they form the foundation on which the aqueous rocks were afterwards superimposed. For instance, they compose the central line of a range of mountains, on both sides of which sedimentary rocks are deposited. Thus, in reference to their *age*, they are considered as the oldest, and are therefore called also *Primitive*.

There are exceptions to this rule in reference to the age of certain plutonic rocks of *eruptive* character. But I am now stating only general principles, and therefore avoid all questions leading to scientific discussions.

The next in order are the *aqueous* rocks—the production of watery action. They are also called *sedimentary* rocks, from the fact that they are the hardened sediments accumulated at the bottom of the sea or of fresh-water lakes. They are stratified, or divided into distinct layers or strata: as, for example, clay-slate, marl, sandstone, limestone, and are divided into three kinds, called *arenaceous* or *siliceous*, *argillaceous* or *clayey*, and *calcareous* or *chalky*—according to the respective predominance of Silica, Alumina, or Lime. Rocks of this class cover a larger part of the earth's surface than any others, and are of the greatest interest on account of the *organic* remains which are found imbedded in the different strata.

There are two principal means of ascertaining the relative age of aqueous rocks—derived, the one from their *position*, the other from the *fossil remains* they contain.

With reference to *position*—the bed which lies uppermost, is of course the newest of all, and that which lies at the bottom, the most ancient.

With reference to the *fossils* it is not so easy to give an explanation in few words; but some idea may be formed from the well-ascertained fact, that certain animals have existed for a certain period, and then wholly disappeared and been succeeded by other animals of different species, which, in turn, have again given place to others.

So, as Sir Charles Lyell truly says, " a series of sedimentary formations is like volumes of history, in which each writer has recorded the annals of his own times, and then laid down the book with the last written page uppermost." And the organic remains are, as Dr. Mantell beautifully expresses it, the " coins of Creation," which give us the means of tracing the history of the development of the organic kingdoms.

Thus, by superposition and by their organic remains, the aqueous rocks are divided into groups forming, in reference to their age, what is termed an " ascending series," or beginning with the oldest in the following manner :—

1. Primary formations or periods.
2. Secondary ,, ,,
3. Tertiary ,, ,,
4. Quartary ,, ,,

In reference to the word " quartary," I may explain that, although it is not an English word, I take the liberty to use it in the sense of " post tertiary," as following the analogy of the other terms.

Each of those formations is again divided into numerous minor systems, on which I have no time to enter.

The fourth and last great division of rocks are the *volcanic*—as Trachyte, Basalt, Breccia, and Tuff—all produced by supramarine or submarine volcanic eruption. It is ascertained that the earliest true volcanic eruptions have occurred subsequently to the secondary period, commencing in the Tertiary, and continuing to the present time; and it is a marked difference between the older and the more recent eruptions.

I have prepared a diagram which will serve to impress these first principles upon your memory, and so enable you to follow me in the account I have to give :—

DIAGRAM.

Origin.	Age.	Organic Remains.
Plutonic and Metamorphic rocks....	Primitive formation.	No fossils.
Aqueous............	Primary. Secondary. Tertiary.	Fossiliferous.
Volcanic....	Quartary. Trachytic. Basaltic.	No fossils.

With these preliminary remarks, I now proceed to the main subject of my lecture.

GEOLOGY OF THE PROVINCE OF AUCKLAND.

The first striking characteristic of the Geology of this Province —and probably of the whole of the Northern Island of New Zealand—is *the absence of the primitive, plutonic, and metamorphic* formations, as granite, gneiss, mica-slate, and the like. I have been informed by Mr. Heaphy, that these rocks are of wide-spread extent in the Middle Island, forming mountain ranges of great altitude, covered with perpetual snow, and reaching in Mount Cook probably to 13,000 feet. The rocks of these formations contain the principal metallic riches of the earth. Therefore we cannot hope to find these riches developed in the highest degree in the Northern Island; but as other formations also contain metalliferous veins, there may be found many mines worth working in the rocks I am about to describe.

I.—PRIMARY FORMATION.

The oldest rock I have met with in the Province of Auckland belongs to the *primary formation.* It is of very variable character—sometimes being more argillaceous, of a dark blue colour, (when decomposed, yellowish brown, the colour generally presented on the surface,) and more or less distinctly stratified like *clay-slate*—at Maraitai on the Waitemata); at other times the siliceous element preponderates, and, from the admixture of oxide of iron, the rock has a red, jasper-like appearance—(at Waiheki, Manganese Point.) In other localities it is more distinctly arenaceous, resembling the old Sandstones of the Silurian and Devonian Systems, called Grauwacke—(at Taupo, on the Hauraki Gulf.)

As no fossils have yet been found in this formation in New Zea-

land, it is impossible to state the exact age : I am, however, of opinion, that these argillaceous siliceous rocks will be found to correspond to the oldest Silurian strata of Europe.

The existence and great extent of *this* formation are of considerable importance to this Province, as *all the metalliferous veins* hitherto discovered, or likely to be hereafter found, occur in rocks of this formation.

To these rocks belong the *Copper-pyrites*, which has been worked for some years at the *Kawau* and *Great Barrier*—the *Manganese* (Psilomelan) at *Waiheki*—and the *Gold-bearing quartz* at *Coromandel.*

The *gold* which is washed out from beds of quartz-gravel in the rivers and creeks flowing down from both sides of Coromandel range, is derived from quartz veins, of cyrstalline character and considerable thickness, running, in a general direction from North to South, through the old primary rocks which form the foundation of the Coromandel range. In some places these veins stand up like a wall on the summit of the range to a height of eight or ten feet. The clay-slate rock itself is exposed only at the bottom of deep gorges which form the channels of the principal trachytic tuff and breccia, of which the hills surrounding the Harbour of Coromandel are composed. The well-known "Castle Hill"—which can be seen from Auckland—is a characteristic example of the Trachytic Breccia formation. The magnetic iron-sand which, in washing, is found with the gold, is derived from the same source as all the magnetic iron-sand of New Zealand, namely, from the decomposition of trachytic rocks. Small veins of quartz of amorphous character that is, not crystalline, but in the shape of chalcedony, cornelian agate, and jasper—are found in numerous places on the shores of Coromandel. These veins occurring in trachytic rocks, are quite different from the auriferous quartz veins in the primary formation,—a fact, I think, of much practical importance to state, to prevent the fruitless search for gold where gold does not exist. All the gold-bearing gravel in the creeks is derived, as I have already said, not from the veins in the trachytic breccia, but from the much thicker and crystalline veins in the primary rocks. The surface-deposit in those creeks

is very rich, but, as compared with Australian and Californian gold-fields, of limited extent and depth. (*I washed a few bucketfuls of surface earth, and gravel, at a creek pointed out to me by Mr. Charles Heaphy, near Ring's Mill, at the Kapanga. Every panful showed scales of thin gold, with small fragments of quartz streaked and studded with veins and spangles of gold. These " specimens, as they are called by diggers, show no—or very little —sign of being water-worn, but are sharp and crisp fragments, as if they had been broken up on the spot, or in the immediate vicinity. I think the quartz veins in the mountains should be thoroughly examined, and that, when once the day has come that the Coromandel gold-fields are worked, the attention of the " digger" should be directed as well to the hills immediately above any rich deposits as to the alluvial workings below.*)

The Coal Beds at Coromandel occurring between strata of trachytic breccia are too thin to be of any value, and as the coal formation is absent, there is no ground for hoping that a workable seam may be found.

The primary formation occurs, to a more considerable extent, to the Eastward of Auckland, in ranges on both sides of the *Wairoa river* attaining an altitude of 1,500 feet above the sea,—and striking from thence Northwards, over Waiheki and Kawau, to the Bay of Islands. In a Southerly direction, they extend, through the *Hangawera* and *Taupiri* ranges, across the Waikato, through the *Hakari-mata* and *Hauturu* range—parallel with the West Coast—to the Mokau district, where, at Wairere, the Mokau river falls in a magnificent cascade over a lofty precipice of that rock.

The same formation occurs again in the *Rangitoto mountain* on the Upper Waipa, and West of Taupo lake in the *Tuhua* mountains. But the most extensive range of primary rocks is that which commences near Wellington under the name of *Tararua* and *Ruawahine*, and runs in a North-easterly direction to the East shore of Taupo lake, under the name of *Kaimanawa*, in which rises the principal source of the Waikato—there called Tongariro river. The range continues from the shores of Taupo lake, in a North-easterly direction, to the East Cape, under the principal name of *Tewhaiti*. This lofty and extensive mountain range—

the true back bone of the Northern Island—with peaks from 6000 to 7000 feet, is entirely unknown. (*In this range the *Plutonic* and *Metamorphic* rocks, yet unknown in the Northern Island, may perhaps be found *)

Nearly all the primary ranges are covered with dense virgin forests, which render them extremely difficult of access. It must be left to the labour and enterprise of future years to discover and develop the mineral riches, the existence of which appears to be probable, not only from the geological characteristics of the country, but also from some few specimens of Lead and Copper ore that have from time to time been picked up by the Natives.

It is remarkable that, while one of the oldest members of the Primary formation is found so extensively in New Zealand, the later strata, as the Devonian, Carboniferous, and Permian system. appear to be altogether wanting ;—while on the other hand in the neighbouring Continent of Australia these members of the Primary period, together with plutonic and metamorphic rocks, constitute, so far as we know, almost the principal part of the continent.

II.—Secondary Formation.

A very wide interval occurs between the primary rocks of the Northern Island and the next sedimentary strata that I met with. Not only the upper members of the primary series are absent, but also nearly the whole of the secondary formations. The only instance of secondary strata that I have met with, consist of very regular and highly inclined beds of marl alternating with micaceous sandstone, extending to a thickness of more than 1000 feet—which I first saw on the South head of the Waikato, and afterwards met with on the Western shore of Kawhia harbour.

These rocks possess great interest from the fact that they contain remarkable specimens of marine fossils, which belong exclusively to the secondary period, especially Cephalopods of the genera *Ammonite* and *Belemnite*, several species of *Belemnite*, all belonging to the family of the *Canaticulati.* These are the first specimens of those genera which have been discovered in the regions of Australasia. Both fossils have been known for centuries by our ancestors in the Old World—the Ammonite as the horn of

Jupiter Ammon, and Belemnite as the bolts of the God of Thunder. The latter, though now first seen in the Antipodes by Europeans, have long been known to the Natives of Kawhia by a much less dignified name,—the old warrior-chief, *Nuitone te Pakaru*, having told me that the stones I prized so much and collected so greedily, are nothing more than '*roke-kanae*,' which means the excrement of the fish commonly known amongst the settlers by the name of 'mullot.' In reality, the Belemnite belongs to a creature, long since extinct, which was allied to the now living cuttle-fish.

Secondary rocks may probably be found in some other parts of the West Coast, and occur, as I have been kindly informed by the Rev. A. G. Purchas, in the Harbour of Hokianga—but every where of limited superficial extent.

III.—Tertiary Formations.

I proceed now to speak of the Tertiary period, strata of which, of very various characters, occupy a large portion of the Northern Island. The various tertiary strata are found for the most part in a horizontal position—a remarkable fact, from which we may conclude that even the numerous volcanic eruptions which took place during and after the period of their deposition, had not power enough to dislocate the whole system, but merely to produce local disturbances.

The tertiary period must be divided into two distinct formations, which may perhaps correspond to the European *Eocene* and *Miocene*. There is an older formation which is found principally on the West Coast, and in the interior, on both sides of the primary ranges, and a newer one which may be called the *Auckland Tertiary Formation.*

You will probably be interested to have some more minute description of the different strata of the older of these formations, as to this belong the *Brown-Coal* seams, to the discovery of which I am indebted for the opportunity of investigating the Geology of this Province, and on the intelligent working of which I believe very much of the future welfare of this Province depends.

The *Brown-Coal Formation* is of very considerable extent both

in the Northern and Middle Islands of New Zealand, and is of similar character everywhere.

Some months ago I furnished a Report on the Coalfield in the neighbourhood of Auckland, in the Drury and Hunua districts, (*of which I will repeat here the principal points. The Drury coal belongs to a very good sort of brown coal—to the so-called *Glanzkohle*, with conchoidal fracture. I was not able to convince myself of the existence of different series of seams, one above the other on different levels. I am much rather of opinion that the same seam, disturbed in its level, occurs at the different localities in the Drury and Hunua district, where coal is found. The average thickness of that coal seam may be estimated to amount to six feet. The section of the seam at Mr. Fallwell's farm can be taken as a fair average.

The seam consists there of three portions; the upper part a laminated coal of inferior quality, one foot; then a band of shale, two inches; the middle part coal of a good quality, one and a half feet; then a band of bituminous shale, six inches; the lowest part coal of the best quality I have seen, two and a half feet. Thus the whole thickness of the coal itself may be considered to amount to about five feet. The bituminous shale accompanying the coal contains fossil plants, principally leaves of *Dicotyledones*. It is remarkable that no fossil ferns are found in connection with the Drury coal beds; it is the more so, as at the other locality which I must mention—on the West Coast, seven miles from Waikato Heads—*only* fossil ferns, in a most beautiful state of preservation, are imbedded in grey argillaceous strata, alternating with sandstone and small coal seams of, probably, the same geological age as the Drury coal. A considerable number of specimens from both localities will, by a future examination, furnish the opportunity for determining the principal features of the Flora of the *Brown Coal period in New Zealand*.

The fossil gum found in the coal is a kind of "Retinite," derived from a coniferous tree, perhaps related to the Kauri, but it is by no means identical with the Kauri Gum, which is only found in the surface soil in those localities where there have been kauri forests. The fossil gum and gauri gum are very different in their

qualities, as the most simple experiments in their ignition will show.

The thickness of the forest and the inaccessibility of the country prevent our now ascertaining, in an exact manner, the extent of the Drury coal-field. Still the existing openings show an extent of the coal-field quite large enough to encourage any Company to work the coal in an extensive manner.

I am glad to hear that a Company, under the name of "The Waihoihoi Mining and Coal Company" is formed, to begin the working of this coal.*)

The same kind of coal I saw again on the northern slope of *Taupiri* and *Hakarimata range.* At *Kupakupa*, on the left bank of the Waikato, I examined a beautiful seam about 150 feet above the level of the river. The thickness of the seam then exposed was about 15 feet; how much greater the thickness may be it is impossible to say, as the floor has never been uncovered.

This is the seam to which the attention of the inhabitants of Auckland was directed several years ago by my friend the Rev. A. G. Purchas. I believe several tons were at that time brought to Auckland; but, owing to various circumstances—the chief of which was the Native ownership,—the hope of obtaining a supply from thence for Auckland was abandoned. No better position could, however, be found for mining purposes; and the day cannot be far distant when it will be worked to supply fuel for the *steam navigation of the Waikato*—the *main artery of the Province of Auckland.*

I have reason to believe that a Coal Field of considerable extent exists on the borders of the wide plains on both sides of the Waikato, between Taupiri and Mangatawhiri—for which district, shut in on all sides by ranges, I propose the general geographical name of "*The Lower Waikato Basin.*"

A third coal-field exists on the Western and Southern boundaries of the very fertile alluvial plains above the junction of the Waipa and Waikato, which may be distinguished as "*The Middle Waikato Basin,*"—the *future granary* of the Northern portion of this Island.

The localities in which coal has been discovered are the following:—in the Hohinipanga range, west of Karakariki on the Waipa; near Mohoanui and Waitaiheke, in the Hauturu range on the upper branches of the Waipa; and again in the Whawharua and Parepare ranges on the Northern side of Rangitoto-mountains.

THE NEW ZEALAND BROWN COAL.

(*The following are the results of several analysis of specimens of the *Drury Brown Coal*, sent to England some months ago by Mr. Turnbull. The analysis have been forwarded to me by Mr. Farmer.

Laboratory, Museum of Practical Geology,
Jermyn-st., London, April 13, 1859.

Sir,—I have completed the analysis of the coal (lignite) which you left at the Museum, and herewith furnish you with the results of the examination.

I am, Sir,
Your's obediently,
CHAS. TOOKEY.

Brown, Esq.

Per centage composition of Lignite, from Auckland.

Carbon	55·57
Hydrogen	4·13
Oxygen	15·67
Nitrogen	1·15
Sulphur	0·36
Ash	9·00
Water	14·12
	100·00

Coke........................... 50·78 per cent.

The amount of sulphur is small, and this will be a point for favourable consideration in the application of the coal for smelting purposes. The whole of the water is expelled at a temperature of 120° centigrade.

Dundee Gas Works, March 17, 1859.

Analysis of Auckland Coal.

Produce of gas per ton of coal carbonized, 9·632 cubic feet.

Illuminating power of gas, 1·75.

Durability, length of time that a 4-inch jet requires to consume a cubic foot of gas, 53 minutes.

Specific gravity, 495.

Produce of coke per ton, carbonized, 9¼ cwt.

(Signed) John Z. Kay,
Engineer Gas Company.

Gas Works, Berwick, March 12, 1859.

New Zealand Coal.

Gas, in cubic feet, per ton of coal, 7617.

Coke, per ton of coal, in lbs., 1155.

Tar and ammoniacal liquor, per ton of coal, in lbs., 571.

Value of gas, per ton of coal, in lbs. of sperm, 384.

One cubic foot of gas, burned in a No. 2 fishtail burner (or union set), equal sperm candles, 3·12.

Value of one cubic foot of gas, in grains of sperm, 374·40.

Coke, trable, retains the granular structure of the coal; disintegrates when exposed to air; during combustion gives out little heat; and leaves a large mass of stone coloured ash; specific gravity, 1·471.

Composition.	Combustible matter......	39·25
	Silica and alumina.......	54·44
	Protoxide of iron........	6·31
		100·

This coal is well adapted for the purpose of gas manufacture: the quantity produced is not large, but you will observe of a high quality, approaching several of the Scotch cannels in illuminating power.

The coke is of very inferior quality for heating purposes; but the quantity of iron share found in it is so great that it may possibly turn out to be a product of value.

James Patterson,
Civil Engineer.

I subjoin comparative average analysis of the three principal kinds of fuel, from which it may be seen that the Drury Coal is precisely similar to the European brown coals in the proportion of its three principal constituents :

	Wood.		Brown Coal.		Black Coal and Anthracite.	
Carbon....	51·4 to	52·6	55 to	76	73 to	96·51
Oxygen....	43	42	26	19	23	3
Hydrogen..	6	5·5	4·3	2·5	5·5	0·5*)

I embrace here the opportunity of saying a few words on the *commercial value and applicability of the New Zealand Brown Coal.*

Although of entirely different character, and, generally speaking, of inferior value, to the older coals of the Primary formations, I cannot see any reason why this kind of coal should not be used in New Zealand for the same purposes, as a similar brown coal is extensively applied to in various parts of Europe, and particularly in Germany, where it supplies the fuel for manufactures of all kinds, for locomotives and steamers, and for domestic purposes. I am perfectly familiar with this kind of coal, and can assure the people of Auckland, that the brown coal of this country is quite as good as that which is used in Germany for the purposes I have just mentioned. I would strongly recommend that any Company which may be formed for the purpose of working the coal should also at the same time establish *Potteries* for the manufacture of earthenware. Remarkably suitable *Clays* of every necessary variety have been shown to exist in the immediate neighbourhood of the coal-fields, by the borings which have been made by the Provincial Government at my request.* By the establishment of

(* The following are the results of two borings made in the flats between Drury Hotel and the Drury Ranges, under the direction of Mr. Ninnis, to whom I am indebted for the tables subjoined.

BORING NO. I.

	Feet.	Inch.	
1)	2.	0	Dark soil.
2)	9.	6	Plastic clay, yellow and blue.
3)	1.	6	Gravel and pebbles.
4)	1.	0	Yellow clay.
5)	3.	0	Grey clay.
6)	6.	0	Blue clay.
7)	11.	0	Arenaceous clay.
8)	15.	0	Grey clay.

such works, the value of the coal would be made apparent to everybody, and the manufacture itself, if properly conducted, cannot fail to be remunerative. It may be interesting to you to know that the far-farmed "Bohemian Porcelain" is burnt by means of brown coal, from a seam of, in some places of 90 feet thickness. While stating the uses to which brown coal may be applied, I must warn you against thinking that it is suitable for steamers having to make long sea voyages. The bulky nature of the "brown coal" will always prevent such steamers taking it on board when they can procure "black coal." (*But on the other hand, its qualities as a gas-producing coal, as the above analysis show, will render it valuable as an article of export.*)

I now come to another series of the older Tertiary strata, examples of which are found occurring in great regularity on the West Coast from Waikato to Kawhia. The lowest are argillaceous—the middle calcareous, the upper arenaceous.

The characteristics of the first *clayey strata* are, a light grey colour, very few fossils, small crystals of iron pyrites and glauconitic

	Feet.	Inches.	
9)	2.	0	Greenish clay.
10)	1.	0	Dark grey clay.
11)	5.	0	Bluish grey clay.
12)	2.	0	Sandy clay.
13)	5.	2	Volcanic ashes and gravel.
14)	5.	6	Hard basaltic rock.
	69.	8	

BORING No. II.

1)	1.	0	Dark soil.
2)	7.	0	Yellow clay.
3)	6.	6	White clay.
4)	7.	0	Yellow and red clay.
5)	1.	4	Brown clay.
6)	8.	0	Yellow clay.
7)	5.	0	Brown.
8)	4.	0	Reddish.
9)	10.	0	Brown.
10)	4.	6	Gravel and Volcanic ashes.
11)	9.	6	Hard basaltic rocks.
	63.	10.	

* Of these I would draw attention to No. I., 2 for common pottery, No. I., 6 and 8 for finer stoneware, No. I., 7 for fire bricks. The various coloured clays, No. II., 2 to 9, will be applicable to every kind of pottery. No. II., 8, may be used as a colour of pigment in the same way as ochre and umber are generally used.

grains, which give these clay marls a similarity to the Gault and Green sands of the Cretaceous formation in Europe. They are found on the Eastern branches of Whaingaro, Aotea, and Kawhia harbours.

Of greater interest and importance are the calcareous strata, consisting of tabular *limestone*, sometimes of a conglomerate nature, sometimes more crystalline, the whole mass of which is formed of fragments of shells, corals, and *foramini-feræ*, interspersed with perfect specimens of terebratulæ, oysters and pectens, and other shells. This limestone, when burnt, makes excellent lime, and may be wrought and polished for architectural purposes.

The Beds of Limestone worked by Messrs. Smith and Cooper, in the Wairoa district, belong to this formation, as do also the rich fossiliferous strata from the Waikato Heads towards Kawhia Harbour.

Picturesque columnar rocks of the same nature, looking almost as if they were artificially built of tabular blocks, adorn the entrance to Whaingaroa Harbour; and the romantic limestone scenery, and the fine Caves of the Rakaunui river—a branch of Kawhia Harbour—are deservedly prized by the settlers of Kawhia Harbour.

The Limestone Formation attains its greatest thickness (from 400 to 500 feet) in the Upper *Waipa* and *Mokau* district, between the Rangitoto range and the West Coast. It has in this country many remarkable features.

No one can enter without admiration the Stalactite Caves of *Tana-uri-uri* at Hangatiki and of *Parianewanewa* near the sources of the Waipa—the former haunts of the gigantic *Moa*.

I went into those caves in the hope of meeting with a rich harvest of Moa skeletons, but I was sadly disappointed. Those who had been before me in the days of Moa enthusiasm having carried off every vestige of a bone. Great, however, was my labour, and not little to my satisfaction, in dragging out the head-less and leg-less skeleton of a Moa from beneath the dust and filth of an old raupo hut!—The Maories, seeing the greediness with which the "pakehas" hunted after old Moa bones, have long since carefully collected all they could find, and deposited them in some safe hiding place—waiting for the opportunity of exchanging them

for pieces of gold and silver, showing thus how well they have learnt the lesson taught them by the example of the " pakeha."

The subterranean passages of the rivers in the *Pehiope* and *Mairoa* district are highly characteristic of the limestone formation. The limestone rocks, fissured and channeled, are penetrated by the water, and the streams run below the limestone upon the surface of the argillaceous strata, which I have before mentioned as underlying the limestone. This also explains the scarcity of water on the limestone plateau which divides the sources of the Waipa and Mokau rivers. The plateau is covered with a splendid growth of grass, and would form an excellent cattle run but for the deep funnel-shaped holes which everywhere abound. The Natives call them " *tomo*." They are similar to the holes which occur in the limestone downs in England, and on the Karst mountain on the shore of the Adriatic Gulf, where they are called " *dolines*."

The third and uppermost stratum of the older tertiary formation consists of beds of fine fossiliferous *sandstone*, in which quarries of good building stone may be found. There are whole ranges parallel to the primary mountains which seem to consist of this sandtone. I will mention only the *Tapui-wahine* range, about 2000 feet above the level of the sea, in which is the pass from the Mokau to the Whanganui country.

Without a map on a large scale, which I have had no time to prepare, it would be useless to enter more minutely now into a description of the various localities in which the different formations occur. I may, however, mention that limestone and brown coal have been found in places to the North of Auckland, in the districts from Cape Rodney to the North Cape.

The horizontal beds of sandstone and marls which form the cliffs of the Waitemata, and extend in a Northerly direction towards Kawau, belong to a newer tertiary formation, and, instead of coal, have only thin layers of lignite. A characteristic feature of this *Auckland tertiary formation* is the existence of beds of volcanic ashes, which are here and there interstratified with the ordinary tertiary layers.

I must say no more on the tertiary sedimentary formations, in

order that I may leave some time to devote to the *volcanic* formations which, from their great extent and the remarkable and beautiful phænomena connected with them, render the Northern Island of New Zealand, and especially the Province of Auckland, one of the most interesting parts of the world.

VOLCANIC FORMATIONS AND PHÆNOMENA.

Lofty trachytic peaks covered with perpetual snow, a vast number of smaller volcanic cones presenting all the varied characteristics of volcanic systems, and a long line of boiling springs, fumaroles, and solfataras, present an almost unbounded field of interest and, at the same time, a succession of magnificent scenery.

It is only through a long series of volcanic eruptions, extending over the tertiary and post tertiary periods, that the Northern Island has attained its present form. It would be a difficult task to point out the ancient form of the antipodean Archipelago, the site of which is now occupied by the Islands of New Zealand. I must confine myself to a simple indication of the events which have given this country the form it was found to have by the South-Sea Islanders on their arrival, many centuries ago, from the Samoan group,—a form in all main respects the same as is now before our eyes.

The first volcanic eruptions were *submarine*, consisting of vast quantities of trachytic lava, breccia, tuff, obsidian, and pumice-stone, which, flowing over the bottom of the sea, formed an extensive submarine volcanic plateau. The volcanic action continuing, the whole mass was upheaved above the level of the sea, and new phænomena were developed. The eruptions going on in the air instead of under the sea, lofty cones of trachytic and phonolithic lava, of ashes and cinders, were gradually formed. These eruptions, breaking through the original submarine layers of trachytic lava, breccia and tuff, raised them, and left them, as we now find them, forming a more or less regular belt round the central cones, and having a slight inclination from the centre outwards. These belts I shall have occasion to refer to under the same of "*tuff-craters*," or *cones of tuffs*," or *craters of elevation*." In the course of time the volcanic action decreased, and we must now

imagine that tremendous earthquakes occurred—that parts of the newly-formed crust gave way and fell in, forming vast chasms and fissures, which are now occupied by the Lakes, Hot Springs, and Solfataras.

Thus we now find in the central part of the Northern Island an extensive volcanic plateau of an elevation of 2000 feet, from which rise two gigantic mountains, *Tongariro* and *Ruapahu.* They are surrounded by many smaller cones, as Pihanga, Kakaramea, Kaharua, Rangitukua, Puke Onake, Hauhanga. The natives have well named these latter, " the wives and children of the two giants Tongariro and Ruapahu;" and they have a legend to the effect, that a third giant named *Taranaki,* formerly stood near these two—but quarrelling with his companions about their wives, was worsted in combat, and forced to fly to the West coast, where he now stands in solitary grandeur, the magnificent snow-capped beacon of Mount Egmont (8270 feet). These are the three principal trachytic cones of the Northern Island.

By far the grandest and loftiest of the three is *Ruapahu,* whose truncated cone, standing on a basis of about 25 miles in diameter, attains a height of 9 to 10,000 feet above the level of the sea—about 3,000 feet of which is covered with glaciers and perpetual snow. Ruapahu, like Taranaki, is extinct. *Tongariro* alone can be said to be active. I was enabled to distinguish five craters on Tongariro, three of which are to a certain extent active. Steam is always issuing from them, and the natives state that from the principal crater, called *Ngauruhoe,* on the top of the highest cone of eruption (7500 feet), occasional eruptions of black ashes and dust take place, accompanied with loud subterranean noises. I may remark, that the shape of the cone is changing, the western side, for instance, having, during the great earthquake at Wellington, in 1854, fallen in, so that the interior of the crater is now visible from the higher points in the Tuhua district on the Upper Whanganui. The remarkable fact, that snow does not rest upon some of the upper points of the Tongariro system, while the lower ones are covered all the winter through, shows that those parts are of a high temperature.

(*I had no opportunity myself of ascending Tongariro, but I have

met with the following interesting account of an ascent of the highest cone of eruption by Mr. H. Dyson, which was communicated to the *New Zealander* by A. S. Thomson, M. D.:—

Mr. Dyson's Account of his Ascent of Tongariro.

In the month of March, 1851, a little before sunrise I commenced my ascent alone, from the north-western side of the Rotoaire lake. I crossed the plain and ascended the space to the Northward of the Whanganui river. Here I got into a valley covered with large blocks of scoriæ, which made my progress very difficult. At the bottom of the valley, runs the Whanganui river. After crossing the river, which at this place was then not more than a yard broad, I had to ascend the other side of the valley, which, from the unequal nature of the ground, was very tedious, and I kept onwards as straight as I could for the top of the mountain. At last I came to the base of the cone, around which there were large blocks of scoria which had evidently been vomited out of the crater, and had rolled down the cone. The most formidable part of my journey lay yet before me, namely the ascent of the cone, and it appeared to me from the position where I stood that it composed nearly one-fourth of the total height of the mountain. I cannot say at what angle the cone lies, but I had to crawl up a considerable portion of it on my hands and feet, and as it is covered with loose cinders and ashes, I often slid down again several feet. There was no snow on the cone or the mountain, unless in some crevices to which the sun's rays did not penetrate. There was not on the cone any vegetation, not even the long wiry grass which grows in scanty patches up to the very base of the cone. The ascent of the cone took me, I should think, four hours at least; but as I had no watch, it is possible from the laborious occupation I was at, that the ascent of the cone looked longer than it was. But whether it was three hours or four that I was clambering up the cone, I recollect I hailed with delight the mouth of the great chimney up which I had been toiling. The sun had just begun to dip, and I thought it might be about 1 p. m., so that I had ascended the mountain from the Rotoaire lake in about eight hours. I must confess as I had scarcely any food with me that I kept pushing on at a good pace. On the top of Tongariro I ex-

pected to behold a magnificent prospect, but the day was now cloudy and I could see no distance. The crater is nearly circular, and from afterwards measuring with the eye a piece of ground about the same size, I should think it was six hundred yards in diameter. The lip of the crater was sharp: outside there was almost nothing but loose cinders and ashes; inside of the crater there were large overhanging rocks of a pale yellow colour, evidently produced by the sublimation of sulphur. The lip of the crater is not of equal height all round, but I think I could have walked round it. The southern side is the highest, and the northern, where I stood, the lowest. There was no possible way of descending the crater. I stretched out my neck and looked down the fearful abyss which lay gaping before me, but my sight was obstructed by large clouds of steam or vapour, and I don't think I saw thirty feet down. I dropped into the crater several large stones, and it made me shudder to hear some of them rebounding as I supposed from rock to rock,—of some of the stones thrown in I heard nothing. There was a low murmuring sound during the whole time I was at the top, such as you hear at the boiling springs at Rotomahana and Taupo, and which is not unlike the noise heard in a steam engine room when the engine is at work. There was no eruption of water or ashes during the time I was there, nor was there any appearance that there had been one lately. I saw no lava which had a recent appearance; notwithstanding all this, I did not feel comfortable where I stood in case of an eruption. The air was not cold—the ascent had made me hot—but I had time to cool, for I remained at the crater nearly an hour. At about 2 p. m., I commenced my descent by the same way that I ascended. A fog or cloud passed over where I was, and caused me to lose my way for a short time. When descending I saw between Tongariro and Ruapahu a lake about a mile in diameter. I could see no stream flowing out of it on its western side. An extinct crater may also be seen near the base of Tongariro. It was almost dark before I reached the Whanganui river, and, although in strong condition and a good walker, I felt completely done up, and I fell asleep in a dry water-course. The night was cold, but I slept soundly until daylight, when I immediately rose and con-

tinued my descent, and at 10 a. m., I reached my residence at Rotoaire, with the shoes almost torn off my feet.

As far as I can learn, Mr. Dyson, in 1851, and Mr. Bidwell, in 1839, are the only Europeans who have ascended the highest cone of Tongariro.

The difficulty of ascending Tongariro is still the same as when Dr. Thomson published the foregoing account. "It does," as he says,

"Not entirely arise from its height, or the roughness of the scoriæ, but from the hostility of the Natives, who have made the mountain "tapu," or sacred, by calling it the backbone and head of their great ancestor. All travellers who have asked permission of the Natives to ascend Tongariro, have met with indirect refusals. The only way to get over this difficulty is, to ascend the mountain unknown to the Natives of the place, or even your own Natives. Mr. Dyson did this, but his ascent was discovered by a curious accident. During his progress up the mountain he took for a time the little frequented path which leads along the base of Tongariro to Whanganui. A Native returning from that place observed his foot-marks, and knew them to be those of a European. As he saw where the footsteps left the path, he, on his arrival at Rotoaire, proclaimed that a European was now wandering about alone on the sacred mountain of Tongariro. The Natives immediately suspected it was Mr. Dyson, and they went to his house, waited his return, and took several things from him. He was now a suspected man, and his conduct was watched."

The second active crater of the Tongariro system, at the top of a lower cone North of Ngauruhoe, is called *Ketetahi*. According to the Natives the first eruption of this crater took place simultaneously with the Wellington earthquake of 1854. From Taupo lake I saw large and dense volumes of steam, larger than those from Ngauruhoe, emerging from the Ketetahi crater. The third active point on the Tongariro system is a great Solfatara on the north-western slope of the range. The hot sulphurous springs of that solfatara are often visited by the Natives on account of the relief they experience in respect to their cutaneous diseases.*)

A grand impression is made upon the traveller by those two

magnificent volcanic cones,—Ruapahu, shining with the brilliancy of perpetual snow,—Tongariro, with its black cinder-cone capped with a rising cloud of white steam;—the two majestic mountains standing side by side upon a barren desert of pumice (called by the Natives, *One-tapu,*) and the whole reflected, as by a mirror, by the waters of Lake Taupo.

LAKE TAUPO is 22 English miles long in the direction from Terapa to Tapuaeha ruru, and 16 broad. This lake is surrounded by elevated pumice stone plateaus, about 2000 feet above the sea, and 700 feet above the lake. The Waikato river, taking its rise from Tongariro, flows through the lake, traversing the pumice-stone plateaus on either side. In accordance with the names I have already proposed for the Middle and Lower Waikato Plains, the Taupo country will form the " *Upper Waikato Basin.*"*

It is one of the most characteristic features in the structure of the Northern Island, that, from the shores of Taupo lake, an almost level pumice-stone plain—called *Kaingaroa Plain*—stretches at the foot of the East Cape range, with a very gradual descent to the coast between Whakatane and Matata. A plain which, though now presenting a sterile appearance, will, I hope, at no distant day, be converted into fine grassy plains, capable of supporting large flocks of sheep.

In a similar way, a higher volcanic plateau, consisting of trachytic tuff and breccia, and various other volcanic rocks, stretches in a more northerly direction to the East Coast, between *Maketu* and *Tauranga*, the farthest extremities of which reach even to the Auckland District. On one side of Hauraki Gulf, the Coromandel range is covered with trachytic breccia, and again, on the West coast, the same rock forms the coast range from *Manukau*

* The following positions of some of the principal points in the Upper Waikato Basin, as they result from my observations, may be of interest :—

	Lat. S.	Long. E. from Gr.
Ruapahu Centre	39° 1'	175° 38'
Tongariro, Ngauruhoe Crater	38° 54'	175° 41'
Waikato, entrance into Taupo lake	38° 42'	175° 48'
" outlet from Taupo lake	38° 31'	176° 2'
Tukawa, Te Heu Heu's Pa on the shore of Taupo	38° 41'	175° 48'

to *Kaipara.* This extensive plateau is intersected by many deep valleys, the sides of which are characterised by a succession of remarkable terraces. The same plateau is also broken in many places by more or less regular trachytic cones from 1000 to 3000 feet high. That you may become acquainted with the geological character of such mountains, I will mention several examples, the names of which are well known amongst European settlers. To this class of mountains belong *Karioi* on the West Coast, near Whaingaroa, *Pirongia* on the Waipa, the regular cone of *Kakepuku* between the Waipa and Waikato, *Maungatautari* on the Waikato, *Aroha* on the Waihou, *Putauaki* or Mount Edgecombe on the East Coast, and many others. The only active mountain which belongs to this class is *Whakari* or White Island, in the Bay of Plenty, a solfatara like the active crater of Tongariro.

(*Mr. David Burn, in his account of " A Trip to the East Cape," says:—

" In about an hour after passing Flat Island, the snowy vapour upon White Island began to be discernible. By 1 p. m. we were in immediate contiguity with this remarkable island, passing quite close to its southern extremity. As we made our gradual approach, its aspect was of the most singular description. Except on its northern point, to which the sulphurous vapour does not seem to reach, it is utterly destitute of vegetation; there are patches of growing underwood; but in every other direction, the island is bald, bleak, and furrowed into countless deep-worn ravines. After we had passed it a short distance to the eastward, the capacious basin of the crater, with its numerous geysers roaring and raging, exposed its sulphurous bosom to our eyes and nostrils. If the outer and western sides of White Island be blank and furrowed, its inner circle is chased, as it were, in a rare and picturesque manner,—the sides of the hills, from their lofty mountain summits to the base, being *combed* into innumerable longitudinal ridges of a florescent bronze of brilliant and variegated hue."

Of this island, Captain Drury, of H. M. S. " Pandora," gives the following description in the " New Zealand Pilot:"—

" White Island, or Whakari, is about three miles in circumference, and 860 feet high. The base of the crater is one and a half

miles in circuit, and level with the sea. In the centre is a boiling spring about 100 yards in circumference, sending volumes of steam full 2000 feet high in calm weather. Around the edges of the crater are numberless smaller geysers sounding like so many high pressure engines, and emitting steam with such velocity, that a stone thrown into the vortex would immediately be shot in the air.

" Here and there are lakes of sulphurous water, dormant; but the whole island is so heated as to make it difficult to walk. From the edges of the crater the scene below is only to be compared to a well dressed meadow of gorgeous green, with meandering streams feeding the boiling cauldron; but on approaching, we find this green to be the purest crystallised sulphur.

" No animal or insect breathes on this island, scarcely a limpet on the stones, and 200 fathoms will hardly reach the bottom within half a mile of its shores."

" Being under the lee of the island and in smooth water, Captain Bowden, in the most obliging manner, hove the steamer to, and, lowering one of the quarter boats, conveyed us on shore to enjoy a personal inspection of this grand natural curiosity. There are two spots at which a landing may be effected, at the openings of the outer base of the crater; by a very little exertion in clearing away some of the boulders, the landing may be rendered perfectly easy; but although, this day, the water was smooth, still there was such a swell that judgment and caution were requisite to pick out a spot where best to escape the rollers that tumbled on the rough and broken beach."

Never shall we forget the grand displays which we beheld in this sulphurous cauldron. Its paintings fresh from Nature's hand —its lake of gorgeous green—its roaring jets of stormy vapour— are things to be witnessed, difficult to be described; but surpassing all these, and as if their central attraction, there was a fountain, seemingly of molten sulphur in active play, which shot a column of wide spreading green and gold into the scorching atmosphere. The beauty of this fountain was surpassing, and we were under the impression, that from its energy, the volcano was more than commonly active in its workings. We were very circumspect in our approaches, as the surface in places was soft and yielding, and we

knew not to what brimstone depths an unwary step might sink us. Our difficulty in walking, therefore, arose less from the heat, though that in places was great, than from the apprehension of sinking too far in the soft crustaceous surface, from which diminutive spouts of vapour would spit forth as if to resent our intrusion. Whenever we thought the ground at all doubtful, we sounded our way by hurling large stones to see what impression they would make, and we adventured or avoided proceeding accordingly.

Time, to our great regret, would not admit of a minute exploration, but all the grand features of the island had passed under view. We looked in vain for the gorgeous meadow described by Captain Drury; but we had only to enlarge any of the numberless miniature vapour holes to obtainpure crystallised sulphur *hot from the bakery*, and at the same time to convert these holes into more active vapour jets. The streams that issued in various directions were of boiling heat, limped and tasteless; but though sulphur was everywhere strewn around, it did not appear to be in quantities sufficient for shipment. After an hour's stop, we returned to our ship greatly delighted with the visit, and much indebted to our obliging Captain for having put it in our power to enjoy it.

Mr. Heaphy has kindly furnished me with a map and views of this singularly interesting island.*)

If wetake a wider viewof the geological features and the physical outline of these just described high plains and plateaus consisting of regular layers of trachytic rocks, breccia, and tuff, we shall find that the steep cones of Ruapahu and Tongariro rise from the centre of a vast tuff cone of extremely gradual inclination, the basis of which occupies the whole country from shore to shore—from East to West—having a diameter of 100 sea miles, and forming the largest cone of *tuffs*, or in other words, the largest *crater of elevation* in the whole world.

The Hot Springs.

Intimately connected with the described volcanic phænomena of the active and extinct volcanic mountains, are the *Solfataras*, *Fumaroles*, and *Hot Springs*. They are found in a long series stretching across the country in a N. N. E. direction, from the active crater Ngauruhoe in the Tongariro system, to the active crater of

White Island (Whakari). They occupy the chasms and fissures to which I have already referred.

There is only one other place in the world in which such a number of hot springs are found that have periodical outbursts of boiling water—that is in *Iceland*, the well-known *geysers* of which are of precisely similar character to those in New Zealand. The geysers or boiling fountains of Iceland, long celebrated for possessing this property in an extraordinary degree, have, indeed, strong rivals in the *puias* and *ngawhas* of New Zealand. Although there may be no single intermittent spring in New Zealand of equal magnitude with the great geyser in Iceland, yet in the extent of country in which such springs occur, in the immense number of them, and in the beauty and extent of the siliceous incrustations and deposits, New Zealand far exceeds Iceland.

In enumerating the principal of these phænomena, we may begin with—

1. The active craters of *Tongariro*, which are at present in the condition of solfataras that may be called the state of repose of active craters, and with the hot springs rising on the slope and at the base of that mountain.

2. We then pass on to the *Tokanu* and *Terapa* springs, on the Southern extremity of Taupo lake. The principal " puia" at Tokanu is called *Pirori*, an intermittent fountain whose column of boiling water, of two feet in diameter, sometimes reaches a height of more than 40 feet.

3. On the opposite side of Taupo, at the Northern extremity of the lake, we again meet with hot springs, and with a river of warm water called *Waipahihi*, which, rising in the extinct volcanic cone of Tauhara, falls, in a vapour crowned cascade, into Taupo.

4. Descending from Taupo by the outlet of the Waikato, we find, on the left bank, in the midst of a great number of pools of boiling mud, a fumarole called *Karapiti*, an enormous jet of high-pressure steam, escaping with such force as to produce a sound like letting off the steam from huge boilers and as to eject to a great height sticks, or the like, thrown in by the curious traveller. On the right bank is another fumarole of similar character, called *Parakiri*.

5. About twenty-five miles below the outlet of the Waikato from Taupo, at the 'pa' *Orakei-korako*, both banks of the rapidly-flowing river are perforated, in more than a hundred different places, by fumaroles and boiling springs, most of which are of the intermittent kind; and siliceous incrustations of beautiful colours decorate the banks of the river. *Temimi-a-Homaiterangi*—the principal geyser—throws up its large column of boiling water at intervals of about two hours to a height from 20 to 30 feet. An immense volume of steam succeeds the jet, and the water then suddenly sinks into the basin.

6. At Orakei-korako the line of hot springs crosses the Waikato, and continues along the foot of the very remarkable *Pairoa range* on the Easterly side of the Waikato. The almost perpendicular Western side of this range is caused by an immense 'fault' in the volcanic plateau, corresponding to a deep fissure in the earth-crust, from which sulphureous acid, sulphuretted hydrogen, sulphur and steam, are continually escaping, while huge bubbles of boiling ash-coloured mud are rising on the surface.

7. From the same range, the warm-water river *Waikite* takes its origin. On both sides are deep pools of boiling water, on the margins of which we discovered most beautiful ferns, hitherto unknown, one species belonging to the genus *Nephrolepis*, the other to the genus *Goneopteris*. These ferns are remarkable not only for their elegance, but also from the peculiar circumstances under which they exist, as they are always surrounded by an atmosphere of steam.

8. We now come to the well-known ROTOMAHANA, the most wonderful of all the wonders of the Hot Springs district of New Zealand. I will not attempt to describe in a hasty lecture like this the beauties of this Faëry-land. Whoever has once had the happiness to look into the blue eyes of *Otukapuarangi* and *Te Tarata* can never forget their charms; and whoever has stood beside the boiling surf of the *Ngahapu* basin will always retain a vivid impression of its terrors. The terraces of siliceous deposit on the shores of Rotomahana are unequalled in the world, nor is there any thing that even bears any resemblance to them.

9. On the *Rotorua* lake the intermittent boiling springs of *Wha-*

ka-rewarewa are the most interesting. *Waikite*, the principal "ngawha," issues from the top of a siliceous cone some 20 feet high, and is surrounded by several smaller geysers, boiling mud-pools, and solfataras. At intervals of considerable length, sometimes extending to many months, all these '*ngawhas*' begin to play together and form a scene which must be most wonderful and beautiful.

The hot springs of *Ohinemutu* form agreeable bathing-places, the fame of which is already established.

10. The last in the line are the great solfataras on the pumice-stone plateau between Rotorua and Rotoiti—such as *Tikitere* and *Ruahine*.

I will now say a few words in explanation of these phænomena. All the waters of the Springs are derived from atmospheric moisture, which, falling on the high volcanic plateau, permeates the surface and sinks into fissures. Taupo—the axis of which corresponds with the line of the Hot Springs—may also be considered as a vast reservoir, from which the lower springs are supplied. The water, sinking into the fissures, becomes heated by the still-existing volcanic fires. High-pressure steam is thus generated, which, together with the volcanic gases, decompose the trachytic rocks. The soluble substances are thus removed by the water, which is forced up, by the expansive force of the steam and by hydrostatic pressure, in the shape of boiling springs. The insoluble substances form a residuum of white or red fumarole clay, of which the hills at Terapa round Rotomahana and the Pairoa consist.

All the New Zealand hot springs, like those of Iceland, abound in Silica, and are to be divided into two distinct classes—the one *alkaline*, and the other *acid*. To the latter belong the solfataras characterised by deposits of sulphur, and never forming intermittent fountains. All the intermittent springs belong to the alkaline class, in which are also included the most of the ordinary boiling springs. Sulphurets of Sodium and Potassium, and Carbonates of Potash and Soda, are the solvents of the Silica, which, on the cooling and evaporation of the water, is deposited in such quantities as to form a striking characteristic in the appearance of these springs.

Here I must leave this interesting subject. To enter more deeply into the theory of these phænomena would be out of place here. It may be, however, well to mention that numerous facts prove that the action which gives rise to the hot springs is slowly diminishing.

I must also state my conviction that ere long these hot springs will be visited by many travellers, not only for the sake of their beauty and interest, but also for the medicinal virtues they have been proved to possess. Already many Europeans have bathed in, and derived benefit from, the warm waters at Orakeikorako and Rotomahana.

I am unwilling to omit the interesting legend current among the Natives in reference to the origin of these hot springs. The legend, as told by Te Heuheu, the great chief on the Taupo lake, is the following:—

The great Chief *Ngatiroirangi*, after his arrival at Maketu at the time of the immigration of the Maories from Hawaiki, set off with his slave Ngauruhoe to visit the interior, and, in order to obtain a better view of the country, they ascended the highest peak of Tongariro. Here they suffered severely from cold, and the Chief shouted to his sisters on Whakari (White Island) to send him some fire. This they did. They sent on the sacred fire they brought from Hawaiki, by the taniwhas *Pupu* and *Te Haeata*, through a subterranean passage to the top of Tongariro. The fire arrived just in time to save the life of the Chief, but poor Ngauruhoe was dead when the Chief turned to give him the fire. On this account the hole through which the fire made its appearance —the active crater of Tongariro—is called to this day by the name of the slave *Ngauruhoe;* and the sacred fire still burns within the whole underground passage along which it was carried from Whakari to Tongariro.

This legend affords a remarkable instance of the accurate observation of the Natives, who have thus indicated the true line of the chief volcanic action in this island.

Having now described the older and more extensive volcanic phænomena of *the interior*, I proceed to notice the later phænomena of volcanic action in the *immediate neighbourhood of Auckland.*

The Auckland Volcanic District.

The Isthmus of Auckland is completely perforated by volcanic action, and presents a large number of true volcanic hills, which, although extinct and of small size, are perfect models of volcanic mountains. These hills—once the funnels out of which torrents of burning lava were vomited forth, and afterwards the strongholds of savage cannibals—are now the ornaments of a happy land, the home of peaceful settlers, whose fruitful gardens and smiling fields derive their fertility from the substances long ago thrown up from the fiery bowels of the earth.

My Geological Map of the Auckland District contains no less than *sixty* points of volcanic eruption within a radius of *ten miles*—the variety of which, together with the regularity of their formations, gives very great interest to this neighbourhood. The newer volcanic hills round Auckland are distinguished from the older ones in the interior, not only by their age, but by the different character of their lava—the older being *trachytic*, while the Auckland are all *basaltic*. I have not yet mentioned the difference between Trachyte and Basalt. I will therefore say a few words in explanation. The difference consists in the minerals of which the rocks are composed. Trachyte is composed of a mixture of glassy feldspar *(Sanidin)* and hornblende: obsidian and pumice-stone are the usual concomitants of trachytic lava. Basalt consists of a minutely-crystalline mass of feldspar mixed with augit: an admixture of greenish grains of Olivin is characteristic of basalt.

In order to gain a clear idea of the history of the Auckland Volcanoes, we must suppose that before the period in which the Auckland Isthmus was slowly raised above the level of the sea, a submarine volcanic action was already going on. The products of this submarine action are regular beds of volcanic ashes, which form highly interesting circular basins with strata always inclining from within, outwards. You will at once remember several striking examples which I can mention—as the Pupuki Lake on the North Shore; Orakei Bay in the Waitemata; Geddes's Basin *(Hopua)* at Onehunga; and the tidal basin *(Waimagoia)* at Panmure;—Pupuki Lake, believed to be bottomless, has been ascertained by Captain Burgess (who kindly sounded it at my request) to be only 28 fathoms. I call those basins and similar forma-

tions, *tuff craters* or *tuff-cones*. The excellence of the soil of Onehunga and Otahuhu is owing to the abundance of such formations, decomposed strata of which form the richest soil that can be met with. It is curious to observe how the shrewder amongst the settlers, without any geological knowledge, have picked out these tuff-craters for themselves, while those with less acute powers of observation have quietly sat down upon the cold tertiary clays.

After the submarine formation of the tuff-craters, the volcanic action continuing, the Isthmus of Auckland was slowly raised above the sea, and then the more recent eruptions took place by which the cones of scoria, like Mount Eden, Mount Wellington, One Tree Hill, Mount Smart, Mount Albert, and Rangitoto, were formed, (*and great out-flowings of lava took place. Many peculiar circumstances, however, prove that those mountains have not been burning all simultaneously. It can easily be observed that some lava streams are of an older date than others.*) In general the scoria cones rise from the centre of the tuff-craters, (Three Kings, Waitomokia, Pigeon Hill near Howick.) Occasionally, as in the instance of Mount Wellington, they break through the margin of the tuff-crater.

The Crater System of Mount Wellington is one of the most interesting in this neighbourhood, as beautifully shown by the large map, which Mr. Heaphy has kindly prepared for me from actual survey. (*There are craters and cones of evidently different ages. The result of the earliest submarine eruptions is a tuff-crater. The Panmure road passes through the tuff-crater, and the cutting through its brim exhibits beautifully the characteristic outward inclination of the beds of ashes, elevated from their former horizontal levels by the eruptions, which threw up the two minor crater cones south of the road—one of which is now cut into by a scoria quarry. After a comparatively long period of quiescence, arose from the margin of the first crater system the great scoria-cone of Mount Wellington, from whose three craters large streams of basaltic lava flowed out in a Westerly direction, extending North and South along the existing valleys of the country, one stream flowing into the old tuff-crater, and spreading round the bases of the smaller crater cones. The larger masses of these streams flowed in

a South-westerly direction towards the Manukau, coming into contact with the older and long-before hardened lava streams of " One Tree Hill." The traveller on the Great South Road will observe about one mile east of the Harp Inn" the peculiar difference in the colour on the road, suddenly changing from red to black, where the road leaves the older and more decomposed lava streams of One-tree Hill and passes on to the new and undecomposed lava streams of Mount Wellington. The farmers have been able to avail themselves of the decomposed lava surface, which is now beautifully grass covered, but not of the stonefield of the newer Mount Wellington and Mount Smart streams.

The *Caves* at the " Three Kings," Pukaki, Mount Smart, Mount Wellington, &c., are the result of great bubbles in the lava streams—occasioned probably by the generation of gases and vapour as the hot mass rolled onward over marshy plains. These bubbles broke down on their thinnest part—the roof—and the way into the caves is always directly downward.*)

Examples of every gradation may be seen—from the simple tuff-crater without any cone, to those which are entirely filled up by the scoria cones. Especially interesting are those which may be said to represent the middle state, in which there is a small cone standing like an island in a large tuff-crater, and surrounded by either water or swamp. Perhaps the most perfect specimens of this kind occur at Otahuhu and near Captain Haultain's, a map of which, from actual measurement, has been prepared by Mr. W. Boulton. You need not be alarmed when I tell you, that even the very spot on which we are assembled is the centre of an old tuff-crater, from which fiery streams once issued, and which has thrown out its ashes towards the hill on which the barracks stand.—In order to account for these various shapes, it must be borne in mind that the cones of scoria where once higher, but on the cessation of volcanic action they sunk down in cooling, and some entirely disappeared.

That the Auckland volcanoes were, in the true sense of the word, " burning mountains," is proved not only by the lava-streams, which are immense in comparison to the size of the cones, but also from the pear-shaped volcanic bombs which, ejected from the mountain in a fluid state, have received their shape from their ro-

tatory motion through the air. That the eruptions of the Auckland volcanoes have been of comparatively recent date, is shown by the fact that the ashes everywhere occupy the surface, and that the lava-streams have taken the course of the existing valleys. (*This is beautifully exemplified by the probably simultaneous lava streams of Mount Eden, the Three Kings, and Mount Albert, which, flowing through a contracted valley, meet altogether—on the Great North Road—and form *one* large stream to the shore of the Waitemata, terminating on the well-known long reef West of the Sentinel Rock.*) But many thousand years may have passed since Rangitoto, which is probably the most recent of the Auckland volcanoes, was in an active state.

I have been frequently asked whether it is true, as a countryman of mine who some years ago travelled in New Zealand is said to have told the European settlers, that New Zealand is a pleasant country, but that they had come a thousand years too soon. In answer to this I have to remark that any one who knows anything of geological science must be aware, that " a thousand years" is an almost inappreciable space of time in reference to geological changes. And I would rather say, that it would have been better for New Zealand if it had been colonized a thousand years ago, as there would then have been no cause for the discussion of the " Land Question."

I should have much pleasure in saying a great deal more on the Geology of New Zealand, but time will not permit me. Many subjects I have been compelled to omit altogether—such as the Quartary formation in the Drury, Papakura, and Waiuku flats; the Basaltic Boulder formation; the Alluvial formations in the Middle and Lower Waikato Basin, and other places; and I have said nothing of the changes which are now going cn.

The materials which I have accumulated during my six months' sojourn in New Zealand will, I expect, require several years of labour to prepare for publication; and, unless the war which now threatens my own country should unhappily interfere to prevent the completion of the peaceful scientific undertaking of the Expedition to which I belong, it will give me great pleasure to forward to Auckland copies of our publications respecting New Zea-

land, accompanied by an atlas, containing the maps and other illustrations.

In concluding this lecture, I cannot omit the opportunity of saying a few words of farewell to the inhabitants of this Province.

Now that I am on the point of leaving Auckland, I turn in memory to the hour in which I made up my mind to leave my friends on board the Frigate "Novara" and to remain for awhile in New Zealand. I can assure you it was an hour of great anxiety, but I am glad to say I have never regretted the decision to which I with so much difficulty brought myself. Having received assistance in my labours from all sides, I have arrived at results which have afforded me much satisfaction, and which I hope will not be without good fruit to the present and future inhabitants of this Province. Having at first felt some difficulty in making up my mind to remain, I now feel a similar difficulty in leaving. Home-ties, however, are drawing me homewards, and I must quit the country in which I have spent so many happy days. In parting, I have one request to make,—that you will remember me as kindly as I will remember you; and I have one wish—which is for the prosperity of the Colony of New Zealand, and the advancement of the Province of Auckland.

[NOTE.—The chief additions made since the delivery of the Lecture are thus distinguished—(* *).]

II. *Note on the Red Coloring Matter of the Sea round the Shores of the Island of Bombay.* By H. J. CARTER, ESQ., H. C. S., *Bombay.*

(From the Proceedings of the Bombay Asiatic Society.)

FROM "the plagues of Egypt" down to the present day the blood-red color which occasionally makes its appearance in fresh and salt water has been an object of wonder. Numbers of instances of it are recorded by navigators of all ages, as may be seen by reference to M. C. Dareste's excellent "Memoire" on the subject, (Ann des. Ss. Nat. 4th Ser. Zool. t. iii. p. 179.) Be-

sides red, spots of white, yellow, green, and brown water have been seen in different parts of the Globe, but those of red and white are most common in the Arabian and Red Seas, and of these two the red will chiefly occupy us here. They are of transitory duration, and so far as the latter or red color is concerned, receive explanation from what occurs at our own doors, viz., in the sea-water pools left by the reflux of the tide on the shores of the Island of Bombay. A person casually looking at one of these pools would say that a quantity of vermillion had been thrown into it, but on examining the water under a microscope the color is seen to be owing to the presence of red animalcules whose name is *Peridinium.* These are not all red however, for there are many green ones among them, and the former are further observed to be but a transitional state of the latter. This then is the cause of the red color, and its sudden appearance and disappearance may be explained as follows :—

During the first or active part of the *Peridinium's* life, its green color, which depends upon the presence of a substance closely allied to, if not identical with, the chlorophyll of plants, is, with the other internal contents, translucent, and, therefore, reflects little or no light; but gradually, as the time approaches for its transition to another state called the motionless, fixed or protococcus form, a number of semi-translucent, refractive oil-globules are secreted in its interior direct or through transition from starch; the green color disappears, a bright red takes its place; this mixes with the oil, and thus the little animalcule finally becomes visible to the naked eye, and the whole of that portion of the sea charged with them, of course, of a deep vermillion color. This color, however, only lasts for a few days, for they soon assemble together, become individually capsuled, and in this state sink to the bottom in the motionless or protococcus form mentioned. Here duplicative subdivision takes place in several of the capsules, producing two or four new ones from the old *Peridinium*, each of which, on their liberation, may again become capsuled and undergo a further division, and so on probably until their formative force is expended, and they thus pass into dissolution; or a litter of diplociliated monads may be developed in their interior, which may be

the product of a true act of generation, or the final effort to form of the protoplasm, to which I have already called attention in many of the Algae and Infusoria; while the remainder of the red oil which is not required for the nourishment of the monads becomes liberated with the latter on the bursting of the capsule and thus dispersed in the water. A further consequence of the fissiparation is the constant shedding of their capsules, which are always present with them in great numbers, and so brittle that pressure of the thinnest piece of glass bursts them, and again sets free the *Peridinium* when they contain one.

Thus we see that the red color is produced by the formation of oil reddened at the expense of the green chlorophyll. The same process takes place in the little *Protococcus*, which I have heretofore shown to impart the red color to the salt in the salt-pans of Bombay; and again in a freshwater animalcule closely allied to *Peridinium*, viz., *Euglena viridis:* while a more familiar illustration than any is presented to us by the red color which the leaves of some trees assume towards death, viz., the passing of the green chlorophyll and oil into a yellow, brown, and then red, waxy substance, from whence we may also infer that like changes in the *Peridinium* give rise to the prevalence of one or other of these tints in the coloration of the sea.

The species of *Peridinium*, now more particularly under our consideration, I described several years since in its fixed form as) it was submitted to me) undergoing fissiparation (see Dr. Buist's paper on "Discolorations of the Sea, &c." Proceedings of the Bombay Geographical Society, 1855, p. 109,) but never having met with it again in its active state, until the 26th Nov. last, my attention was not again drawn to the subject, nor did I until then know what the animalcule really was. I shall call it animalcule, though, like *Euglena*, and all this class, it really belongs much more to the vegetable than the animal kingdom: and believing the species to have hitherto been unrecognised, its description under the designation of "*sanguineum*" may stand as follows:—

Peridinium Sanguineum, (nov, sp.).—Sub-circular when green, becoming larger and paraboloidal or kite-shaped when red. Compressed, sulcated on one side; surrounded transversely by a deep

groove, the lower lip of which is minutely ciliated. Furnished with a long, large cilium, having a suctorial extremity, which extends backward from the groove on the sulcated side. Body lined with granular protoplasm and chlorophyll, in which is a hyaline vesicle with red eye-spot and a nucleus as in *Euglena.* Chlorophyll becoming of a golden yellow, then brownish, and lastly vermillion red, as the animalcule passes into the protococcus state. Progression waddling the small end forwards, and the large cilium floating behind. Length, 5 to 8-5600ths of an inch. Found in salt-water pools, and in the sea on the shores of the island of Bombay.

What then accounts for the red colour in the sea? Water and salt in the salt-pans at Bombay may account for the red color in the sea-water of other parts, although the animalcules may not be the same, viz., the formation of red oil in their interior. It is interesting, however, to find Darwin's description of the animalcule, which he found to color the sea red a degree south of Valparaiso (his " Journal" on board H. M. S. " Beagle," p. 17). accord exactly with that of *Peridinium*, as may be seen by comparing our descriptions; while it is not less so to find Salt, (Voyage to Abyssinia, p. 195), stating that the animalcules which produced the red color in the Red Sea (15° N.) during the day, became luminous and threw out sparks by agitation after dark ; because, most of Ehrenbergs marine *Peridinea* are phosphorescent. In further confirmation of which, Olafsen and Povelsen's statement may be adduced respecting the red color of the sea on the shores of Iceland, viz., that in 1649, in several gulfs " the night before, the sea appeared all on fire and the day following as red as blood." But it is not necessary for me to cite here all the observations in M. Dareste's " Memoire" in favor of the red color of the sea being in many instances owing to the presence of *Peridinea*, or the white color, to the same animalcules. Suffice it to state that there are many.

With the explanation of the red color then we have that of the white, which is only seen at night, and appears to be produced by phosphorescence generated in the midst of the oil-globules, becoming less and less powerful, probably as the *Perdinium* becomes redder and more nearly approaches to the fixed or protococcus form.

I do not of course allude here to the color of what is termed "whale-water," or to the accumulation of any molluscous animals that can be seen with the naked eye, but exclusively to the color of water produced by animalcules which also must again be distinguished from those that are feeding on them, for where the former abounds the latter are also sure to be present.—Here I have to express my regret that I allowed the red water under consideration to pass away before I thought of ascertaining if the *Peridinium* which colored it was also phosphorescent.

Again, the yellow color may be produced by the chlorophyll passing into golden tint, when the oily appearance, so often noticed on the surface of the sea, might be produced; so also the green color may precede the change in to brown and red as stated in parts of the "Memoire" under reference, extracted from Parry and Scoresby's journals. Scoresby, too, notices that the animalcule was "paraboloidal," and he gives measurements equally small with those of a *Peridinium.*

Of the brown color a word also is necessary. This, which probably depends on the presence of a *Peridinium* in the sea certainly does so on land, for I have had occular demonstration of it in a freshwater tank at Bombay, where, in the beginning of February 1857, it not only turned the water quite brown, but imparted a smell and insipid taste to it, which almost rendered it undrinkable. Professor Allman has described the same phœnomenon, from equal evidence, in the ponds of the "Phœnix Park," Dublin (Trans. Microscope. Soc. London. v. iii. 1855): but the figure he gives of that *Peridinium*, though very like, is not the same as that of the species of Bombay.

Nor should I omit to notice here the æruginous green color, which frequently occurs in our tanks from the presence chiefly of a little Algae called *Flos-quœ*, with which the acicular, fusiform *Aphanizomenon Flos-quœ*,(Linn.) and curled up bead-like *Monormia intricata* (Berk.) are plentifully mingled. This occurs so generally and so abundant, as frequently to render the water not only undrinkable, but to produce an intolerable stench through its putrefaction ; facts which we cannot help associating with the blood-red water of Egypt; and when we add to this the following pas-

sage from an eye-witness of similar occurrence at Porebunder on the coast of Khattywar, where red water is extremely common, viz, the color of the sea-water on Saturday evening last, the 27th October 1849, was changed from its usual tint to a deep red, emitting a most foul smell; the fish speedily were all destroyed, and were washed upon the beach in large quantites &c. &c. " (Proceedings" Bombay, Geograph. Soc., *lot. cit.*); we cannot help ascribing this, independently of the conjecture of the narrator that it might be owing to some sub-marine eruption of mud &c," to the process of oleaginous development and change of color abovementioned in some animalcule, most probably *Peridinium*; and of realizing, at the same time, the (to me) previously incomprehensible Mosaic account of the plague of Egypt, given in the following verses:—

———" and all the waters that *were* in the river were turned into blood."

" And the fish that *was* in the river died; and the river stank, and the Egyptians could not drink of the water of the river; and there was blood throughout all the land of Egypt."—*(Exodus Chap. VII, Vs.* 20 *and* 21.*)*

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II. *On an Extraordinary rise in the Kistna in July* 1859. By W. Knox, Esq., *Collector of Masulipatam.*

(*Communicated by Government.*)

I have the honor to report for the information of the Board, that there was an extraordinary fresh of the Kistna towards the end of last month.

The river rose from 22 feet 6 inches on the 22d to 28 feet 3 inches on the 25th and thence gradually to 37 feet 4 inches on the 30th July ; which is one of the highest freshes on record excepting that of 1853, which was 37 feet $10\frac{1}{2}$ inches. On the 4th instant, the fresh subsided to 30 feet 4 inches and is still subsiding.

Two villages of the Bezoarah talook, not far from the town of Bezoarah, and lying between the river's edge and the embankment, were surrounded by the freshes, which flowed 3 or $3\frac{1}{2}$ feet within the houses. The men and cattle were all saved in time by the prompt exertions of the Tahsildar. The country to the south of the annicuts was secure from the floods, in fact, the ryots in the Delta scarcely knew that there was a high fresh in the river.

The flood swept over the whole talook of Deevi and breached some of the tanks. But the majority of them have received and retained a full supply of water for this season.

The river embankment was breached in two or three places in the Salapully estate, and flooded some of the Zemindars' villages.

The freshes extended to the town of Masulipatam which was quite surrounded by them.

I have not heard of any serious damages having been sustained any where, in consequence of the fresh.

III. *Account of an Earthquake in Guntoor, July* 1859. By J. W. B. DYKES, ESQ., *Officiating Collector of Guntoor.*

(Communicated by Government.)

I have the honor to report for the information of Government, that the District of Guntoor was visited by an earthquake, during the course of last week.

As far as is yet known, I am happy to state that no injury has been sustained, with the exception of the Travellers' Bungalow at Commalpaud,* the walls and arches of which have been cracked in several places. This Bungalow is situated in the Talook of Martoor about 40 miles South West of Guntoor, and in reporting the circumstance, the Tahsildar of that Talook further states that on the Boggoola Hills in the neighbourhood of the Bungalow, in question, large stones had been rolled down into the plains, and that the shaking of the earth accompanied with a rumbling noise had continued at the town of Martoor† at intervals during the whole of the 21st and 22nd Instant.

The shock was also felt at Condaneed‡ on the morning of the 21st Instant, about 4 A. M. The shaking of the earth was accompanied there also with a rumbling noise, but the earthquake did

* Latitude 16° 2' North, Longitude 80° East.
† Latitude 16° North, Longitude 80° 20' East.
‡ Latitude 16° 15' North, Longitude 80° 18' East.

not last more than half an hour, and the only result was some old walls being thrown down.

Condaneed is nearly due West of Guntoor,* where the shock was felt by myself, I was sleeping in an upper room, and was awoke by it. The shock, however, was not severe, and I had in fact forgotten all about it, till the first report was received from the Tahsildars. I regret that I did not make a note of the date, and as I have not heard of the shock having been felt here by others, I am unable to supply the wanting information from other sources; but it probably was the morning of the 21st Instant.

From such reports as I have received as yet, I infer that the direction of the earthquake was North and South.

PROCEEDINGS.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 14*th April*, 1859, *at half past* 6 *o'clock* P. M.

PRESENT.

The Hon. Walter Elliot, Esq., *Chairman.*	H. Nelson, Esq.
Major W. T. Wilson.	G. F. Fullerton, Esq.
E. Maltby, Esq.	H. F. Cleghorn, Esq., M. D.
J. T. Wheeler, Esq.	W. C. Maclean, Esq., M. D.
	W. Huddleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds, prepared up to 14th Instant.

Resolved, that the foregoing Statement is satisfactory and be passed.

Read letters from the Hon'ble Sir H. Davison, Kt. and Sir P. Grant, K. C. B., accepting the office of Vice-President.

Ordered to be recorded.

Read letter from the Private Secretary to the Governor conveying Sir C. Trevelyan's acceptance of the Office of Patron of the Society, and offering from him to the Society a Pali Manuscript.

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* Latitude 16° 18' North, Longitude 80° 30' East.

It consists of 63 double Cadjans inscribed on two sides of each pair, in the Burmese character, and ornamented with Mythological figures executed with the style employed in writing. The Manuscript was obtained in Burmah, by Colonel Trevor of the Madras Horse Artillery and given by him to Sir Charles Trevelyan.

Resolved, that the best thanks of the Meeting be offered to Sir Charles Trevelyan for his present of the Manuscript, which the Committee will endeavour to have examined with a view of ascertaining the nature of its contents translated in full, or abstract.

Read letter, communicated by Sir C. Trevelyan, from Captain Playfair of the Madras Artillery, Assistant to the Political Agent stationed at Aden, forwarding a Photograph of an ancient Hebrew Inscription lately discovered in digging the foundation for the new Barracks at Front Bay, with a fair copy, Glossary and Translation, as obtained from a German Jew on the spot.

The interest turns on the date of the inscription which appears to be an epitaph, and according to the translation given and interpretation placed on it by Captain Playfair would testify to the presence of Jewish Residents at that Port some 2000 years ago.

Resolved, that the best thanks of the Committee be offered to Sir C. Trevelyan for this interesting communication and that measures be taken to obtain a second and independant reading and translation of the inscription, and that the letter with both copies of the inscription and such elucidation of its contents as may be obtained be eventually made over to the Journal Sub-Committee for publication.

The President laid before the Meeting a set of copper plates recording a grant by a local chief of the Chola family amongst whose titles occurs that of "Lord of Nandadurga." This fact is of some value in a historical point of view as confirming a very generally asserted statement, but which has often been doubted, that the Western boundary of Tondamandalam extended to Nandidrug. The fact of a chief of Chola race being designated by the title of Lord of that place goes far to establish the accuracy of the ancient tradition.

The grant differs from all those of similar description hitherto observed in the circumstance of the edges of the copper plates

being bound with a brass edging. The plates which are six in number are united by a ring bearing a seal with the symbol of a battle axe accompanied by the sun and moon.

The language is Sanscrit with a mixture of Tamil in the Grandonic character. Unfortunately the only date is that of the Cycle year. Mr. Elliot is of opinion that it may be assigned to the twelfth or thirteenth century between the decadence of the Chola and the rise of the Bijanagar dynasty.

Resolved, that the thanks of the Committee be offered to the President for this interesting communication.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, held at the Club House on Thursday the* 12*th May* 1859, *at half past* 6 *o'clock* P. M.

PRESENT.

The Hon. Walter Elliot, Esq., *Chairman.*
E. Maltby, Esq.
W. C. Maclean, Esq., M. D.
H. B. Montgomery, Esq., M. D.
Captain G. Winscom,
G. F. Fullerton, Esq.
H. Nelson, Esq.
J. D. Mayne, Esq.
J. T. Wheeler, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds, prepared up to the 12th Instant.

Resolved, that the above Statement is satisfactory and be passed.

Resolved, that application be made to Government for a further advance towards defraying the cost of the Casts of Heads ordered from the Messrs. Schlagintweit, with reference to Extract Minutes of Consultation, dated 3rd May 1859, communicating to the Society a letter announcing despatch of a further portion.

Resolved, that the Third Series of Annals of Natural History be taken in regularly as issued, and that a Second hand Copy of the Second Series at half price be obtained if possible.

Resolved, that a Second hand Copy of Vol. 9, of DeCandollés Prodromus Regni Vegetabilis be ordered.

The Secretary submitted to the Committee a letter addressed to him by Captain Obbard, complaining of the want of light literature in the periodical supplies of books, &c.

Resolved, that Captain Obbard be invited to send in a List of Books which he wishes to be ordered.

The Secretary submits to the Meeting Messrs. Schlagintweit's Circular Letter regarding the fate of their brother Adolphe communicated by the Honorable Mr. Elliot.

Resolved, that the thanks of the Meeting be offered to the President for this Communication.

Read Report from the Sub Committee on Mr. Bayley's proposal for an uniform mode of transliterating Oriental words in Roman characters.

Referred to the Sub Committee of Papers, who are requested to meet this day fortnight to discuss these and other papers for the Journal.

Read also a Paper communicated by Sir C. Trevelyan for publication in the Journal, being Dr. Caldwell's letter to him on the proposal for publishing works in the Oriental languages but in Roman characters.

See last Resolution.

Resolved, that an interchange of publications be made with the Editors of the Atlanté's, and that the Society's Journal, from the commencement of the new Series be forwarded to those gentlemen.

Resolved, that Messrs. Allen and Co. be directed to forward the Annual "Register" as published, and that the Volumes, from the 35th be completed as opportunity offers, at not more than half price.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 9*th June* 1859, *at* 6 *o'clock* P. M.

PRESENT.

The Hon. Walter Elliot, Esq., *Chairman.*
G. F. Fullerton, Esq.
J. T. Wheeler, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 9th June 1859.

Resolved, that the above Statement is satisfactory and be passed.

On the recommendation of the Honorable the President.

Resolved, that Dr. Roust, Principal of the College of St. Augustine, Canterbury, and Messrs. Hermann and Robert Schlagintweit of Berlin, be elected Corresponding Members of the Society.

Mr. Elliot read extract of a letter from Dr. Jameson, Superintendent of Botanical Gardens at Saharunpore, giving an account of the progress of the culture of Tea in the Himalayas. Dr. Jameson states, that " Tea Cultivation in the North West Provinces and Kohistan of the Punjab is now a great fact, and must now proceed with vigour, as numbers of Natives have commenced this cultivation, and in a letter received a few days ago from Sir G. Clerk, who takes great interest in its progress, he states that the Home Government intend to give it their utmost support, this season the out-turn will be lbs. 100,000 of tea, and in addition I have planted upwards of five millions of seedling plants within the last 8 months ; to private parties I have also given this season upwards of $1\frac{1}{2}$ millions of plants and 100,000 lbs. of seeds. In a few years, therefore, I doubt not that the teas of the N. W. Provinces will be exported in vast quantity and form an important export trade, and ere long become one of the staples of this part of India."

Resolved, that " Memoirs of Cochin and Travancore" by Colonel Horsley, and a " series of Meteorological Observations taken at Allepy by Captain Crawford, from 23d April to 6th May last," communicated by the Honorable the President, be transferred to the Sub Committee on Papers, together with " Notes on various subjects" by Lieut. H. P. Hawkes similarly communicated.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 14*th July* 1859, *at half-past* 6 *o'clock* P. M.

PRESENT.

The Hon. Walter Elliot, Esq., *Chairman.*
Major W. J. Wilson.
G. F. Fullerton, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 14th July 1859.

Resolved, that the above Statement is satisfactory and be passed.

Read letter from Monsieur Haidinger, Director of the Imperial Geological Institute of Vienna.

Resolved, that Monsieur Haidinger be referred to the Secretary's letter of 8th February, 1858, from which he will observe that the Numbers of the Journal were sent to Dr. Hochstitter on board the Frigate " Novara."

Read letter from the Director of the Society of Arts and Sciences of Batavia.

Resolved, that a set of the new Series of the Journal be forwarded to the Batavian Society, and that they be informed that the Old Series is incomplete and out of print.

The Secretary submits to the Meeting the following contributions to the Library presented by Sir C. E. Trevelyan.

A Classified List of Books in store in the Book Office, Examiner's Department, East India House.

A Catalogue of Arabic, Persian and Hindústány Manuscripts of the Libraries of the King of Oudh.

Discours de Monsieur Garcin de Tassy, Membre de L'Institute.

Resolved, that the thanks of the Committee be offered to Sir C. E. Trevelyan.

The Secretary also submitted to the Meeting the following contributions to the Library, presented by T. Oldham, Esq., Superintendent of the Geological Survey of India.

Annual Report of the Superintendent of the Geological Survey of India for 1858-59, volume II. part I. of their published Memoirs.

Resolved, that the thanks of the Committee be offered to Mr. Oldham.

The Honorable Mr. Elliot read extract from letter from Mr. H. Blanford, of the Geological Survey, communicating the discovery of the Remains of a gigantic Fossil Saurian in the Trichinopoly District.

These consist of a tooth and some bones of what appears to be a Megalosaurus, and judging from their position in the group of the Trichinopoly cretaceous rocks, the relations of which have not yet been fully worked out, these remains of that gigantic carnivorous sea lizard appear to be much more recent than any that have been discovered in Europe, where it does not occur beyond the Wealden.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, held at the Club House on Thursday, the* 11*th August* 1859, *at half past* 6 *o'clock*, P. M.

PRESENT.

The Hon. Walter Elliot, Esq., *Chairman.*
G. F. Fullerton, Esq.
Major W. J. Wilson,
J. T. Wheeler, Esq.
W. Hudleston, Esq. *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to 11th August 1859.

Resolved, that the above Statement is satisfactory and be passed.

Read Letter from Dr. Mackay, Honorary Secretary of the Neilgherry Public Library, soliciting public aid, and forwarding a List of Contributions.

Resolved, that a set of the new Series of the Journal from the commencement, and further numbers be regularly forwarded for the use of the Neilgherry Library, to which the Society will render all the aid in their power, and that this Resolution be communicated to the Honorary Secretary.

At a Meeting of the Managing Committee of the MADRAS LITERARY SOCIETY, *and Auxiliary of the Royal Asiatic Society, held at the Club House, on Thursday, the* 8*th September* 1859, *at half-past* 6 *o'clock* P. M.

PRESENT.

H. B. Montgomery, Esq.
G. F. Fullerton, Esq.
W. Hudleston, Esq., *Secretary.*

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds prepared up to the 7th Sept. 1859.

Resolved, that the above Statement is satisfactory and be passed.

Read Extract from the Proceedings of the Madras Government, dated 29th August 1859, forwarding Lieut. Vertue's Report on the Jeypore Passes.*

Resolved, that the Proceedings and Report be transferred to the Sub Committee on Papers for publication in the Journal.

Read letter from General Cullen relative to the ancient inscriptions of the Syric Christians and Jews of Malabar.

Resolved, that the thanks of the Society be offered to General Cullen, and that the Papers be transferred to the Sub Committee on Papers for publication in the Journal.

Read letter from N. B. Acworth, Esq., to the Honorable Mr. Elliot, on a piece of Rock Salt from near Kircumbady.

Resolved, that copy of Mr. Acworth's letter be submitted to the Chief Secretary to Government with a view of obtaining further information on the subject.

Read Letter from Dr. Mackay, Honorary Secretary to the Neilgherry Public Library, returning thanks for Seven Numbers of the new Series of the Society's Journal presented to the Library.

Read Letter from the Editor of the "Indian Lancet" presenting No. 1, Vol. 1 of that publication to the Society.

Resolved, that the receipt of the above publication be acknowledged with the thanks of the Society.

Read Letter from Captain H. Crawford forwarding Register of Meteorological Observations on Travancore.

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* Will appear in our next No.—ED. M. L. S. J.

Resolved, that Captain Crawford's Letter be acknowledged with the thanks of the Society, and that the Observations be transferred to the Sub-Committee on Papers for publication in the Journal.

Photographic Society.

At a Meeting of the Photographic Society, *held at the School of Arts on the 7th April* 1859.

Present.

Col. Hamilton, in the Chair.	Lieut. Mitchell.
Col. McCally,	Lieut. Cole.
W. E. Underwood, Esq.	Dr. Scott.

Arrangements were made for the approaching Exhibition which opens on the first Thursday of next month. The Council take the present opportunity of reminding up-country Members and other Photographers of this, and hope the contributions to the Exhibition may be both numerous and liberal. They ought to reach the Honorary Secretary before the end of the present month, and if possible, should be mounted on Card board.

It was also decided that the prints for distribution to Members for the year 1858-59, should comprise two negatives kindly placed at the disposal of the Society by Captain Tripe, and as it was thought desirable to issue to Members one good European photograph to show the progress of the Art at home, it was decided that steps be taken by the Council to secure for this purpose the beautiful copy by Bingham of Airy Sheffer's famous picture of Faust and Margueritte. As this however will entail a considerable outlay, the Council will not be able to give off more than four pictures for this year viz., the three above mentioned, and as they hope to receive a negative of the late Chief Justice Sir C. Rawlinson who has kindly promised to sit for one in London, the portrait of that gentleman will be the fourth.

At the Meeting of the PHOTOGRAPHIC SOCIETY *held on the 5th May* 1859.

PRESENT.

Lieut. Mitchell in the Chair.	Mr. Nicholas.
Col. Mc'Cally.	Dr. Cleghorn.
Col. Hamilton.	Col. Congdon.
Lieut. Cole.	Dr. Pearl.
Dr. Duff.	Dr. Scott.

The Photographs which have been already received for this year's Exhibition were laid on the table, consisting of several excellent contributions from different parts of the Presidency, as also a very fine one from Calcutta. Besides the above, the Secretary mentioned that several more were still expected. A Committee was appointed to arrange the pictures, and it was resolved that the Exhibition should be opened on Thursday the 12th inst., at 5 P. M., to Members of the Society, and to the public from the following morning, at the School of Arts.

As the general impression of the Meeting was that the Exhibition would prove to be a very good one, the Council hope that there will be a large attendance on the occasion of its being opened.

REPORT OF THE COMMITTEE APPOINTED TO ADJUDICATE THE PHOTOGRAPHIC SOCIETY'S MEDALS.

The following is the Report of the Committee appointed to Adjudicate Prizes on the Annual Exhibition of the Photographic Society which opened on the 12th May.

The Madras Photographic Society's Exhibition for 1859 differed considerably from that of last year in more respects than one, contrasting favorably with it more especially as regards the number and quality of the contributions of Indian Photographers. The chief attraction in the Exhibition of last year, consisted principally in the beautiful collection of European photographs contributed for the most part by one or two members, whereas in that of this year the greater part of the works exhibited were executed in India, and chiefly in our own Presidency, there being only a few very fine

prints of LeGray, Fenton, Bisson freres, and Bingham, the property of the Society, and procured for the purpose of showing the present state of the Art at home.

It was also gratifying to observe that the Exhibition of this year excited a much greater degree of general interest than any which has yet taken place in Madras, and during the month it remained open to the public was visited by all classes of the community both European and Native especially on Saturdays afternoon, when the Band of the 2nd Regt. was in attendance by the kind permission of the Officers of that Corps.

Many circumstances conspire in this country to render the pursuit of Photographic Art more difficult and less satisfactory than in the more temperate climate of Europe. The intense heat, light, and frequently too in some parts of the country, an atmosphere overloaded with moisture, form formidable obstacles to the operations of the Photographer in the Tropics. The utmost an amateur can generally accomplish here is to obtain such a picture as the process he may employ affords, for few can give the time, had they even the inclination to make experiments, and it can hardly be expected under such circumstances, that much original observation and researches in this delightful Scientific Art should be developed. Should Collodion be the process he selects; the Indian Photographer very soon discovers the treacherous nature of the material to which he has to trust, how rapidly it becomes deteriorated in a temperature of 90° Fahrenheit, and frequently how uncertain it becomes from day to day as regards the length of exposure required to take a picture whether portrait or landscape. Many kinds of Collodion which are found to answer the purpose perfectly at home prove even on their first arrival in India to be in an unsatisfactory state and decompose so rapidly when iodized as to be next thing to useless. On this account the only resource the Photographer has is to make his own Collodion on the spot from fresh materials, which latter also he finds that in order to ensure success he has himself to prepare, as both Alcohol and Ether as well as gun cotton are too frequently found even when prepared with the greatest care in England to be acid and decomposed, and otherwise unfit for use, on reaching this country.

It is satisfactory however to be able to announce that some Collodion has recently been received in Madras which gives a fair promise of better things. We allude to Thomas' new Negative Collodion which is well spoken of by those who have tried it, as retaining its keeping properties, as well as sensitiveness for a much longer time than any which has as yet found its way to this country. Thus much may be said for Collodion in India, but even those operators who are content to pursue the less uncertain but more troublesome paper processes have their difficulties also to contend with, especially when they come to print from their finished wax negatives. The intense heat of the sun melts the wax, and the prints are too frequently found to be spotted and spoilt with this material, the defect in some cases only being discovered after they have been toned and fixed, though, generally speaking, it can be detected on their removal from the pressure frame.

Considering the difficulties and inconveniences attending photographic operations in India which we have above enumerated, it is a subject for congratulation to members of the Society that their Exhibition of this year proved to be so successful as it was. Besides the numerous contributions from the Madras Presidency, we were likewise much indebted to the Calcutta Photographic Society for several excellent productions contributed by its members, and it cannot but be much regretted that none were this year received from the other sister Presidency, especially as we well know from the Bombay Amateur Photographic Album, that that Presidency is far from being deficient in zealous and successful prosecutors of the Art.

The medals offered by the Society for the best contributions were awarded as follows :—

Gold Medal.

For the best collection of views and landscapes, open to all amateur Members of the Society, to Captain Girdlestone, 11th Regiment N. I.

Silver Medal.

For the best collection of views and landscapes, open to all Members of the Society, to Captain Tripe.

N. B.—This medal having been replaced at the disposal of the

Society by Captain Tripe for reasons given by him in a letter, dated 8th August, appended to this Report, was afterwards awarded to Mr. Butcher, of Palhally, as the next successful competitor

Silver Medal.

For the best collection of views and landscapes, open to all Photographers, to Mr. Williamson, of Calcutta.

Silver Medal.

For the best collection of portraits, open to all Photographers, to Lieutenant H. Macdonald, 35th N. I.

In addition to the above, the Committee recommended that special medals should be awarded to Lieut. Mitchell for Micro-photographs, and to W. Pearl, Esq., for Stereographs.

We must now proceed to enumerate the different contributions in detail, and endeavour to give some idea to up-country Members of the extent and nature of the Exhibition. In doing so, some apology is due for the length of time which has been allowed to elapse between the Exhibition and the appearance of this report, but it must be borne in mind that there are few gentlemen at the Presidency who are at all qualified to draw up a report of this nature, and these have all other and more important duties to attend to, it is therefore a matter of no small difficulty to find persons willing to undertake such a task, and who find themselves by reason of their occupations at liberty to do so. The same apology must also be advanced for any deficiencies which may be observed in the report, and for which it is hoped due allowance will be made.

Captain Girdlestone's contribution consisted of 13 views taken in and around Cannanore by the ordinary Collodion process. These were pleasing pictures and were considered by the Committee to be superior as regards manipulation and printing to those of any other amateur Member of the Society, and coming under the conditions laid down in the Council's Circular as being eligible for the gold medal, *i. e.*, "for the best contribution of not less than 6 pictures," the medal was awarded to this collection.

In Captain Girdlestone's pictures the half tones are well preserved, the focussing at the same time being sharp and clear, and

the tone of a pleasing dark color, without being too black. The skies were well preserved, being clear and without any tinge of yellow. The pictures remained unchanged after their receipt, and gave no indication of fading up to the close of the Exhibition. They were with one or two exceptions printed on plain unalbumenized paper, the best being the Fort Ditch Cannanore, which is an admirable and characteristic picture as are also the Juma Musjid, a Moplah Musjid, Tier Sawmy houses, and a Sketch, Cannanore. Captain Girdlestone was it appears a pupil of Mr. Hardwick, of King's College, London, and has evidently profited greatly from the instruction of his able Master.

Captain Tripe's contribution consisted of 50 large views taken in the neighbourhood of Madura, Trichinopoly and Tanjore. As a collection this was undoubtedly the best in the Exhibition, and the Committee regret much they were precluded from awarding to it the gold medal, as Captain Tripe being the Photographer to Government could not be looked upon as an Amateur Member of the Society; they had much pleasure, however, in awarding him the silver medal which is open to all Members of the Society. But this even Captain Tripe as already mentioned declined to accept from the honorable feelings expressed by him in his letter to the Secretary herewith appended. Captain Tripe's prints are for the most part from Wax-paper Negatives, four only being from dry Collodion Negatives. They illustrate admirably the architecture of the Hindoo Temples and Palaces of Southern India, and in particular the Madura and Tanjore series comprise in this respect all that is most worthy of record in those cities. The interior of that part of the Madura Palace which is now used as the Session Court Room is an excellent picture and is a very good specimen of the dry Collodion, which process has not as yet been much employed in this part of India, but which promises to surpass in many respects the wax paper process especially in being better than that process for taking views of interiors giving the clear and sharp definition of Collodion, and at the same time permitting any necessary amount of exposure. In interiors where there is a deficiency of light, an exposure of several hours may be given without any damage to the plate. Another good specimen of an interior taken by this process is that marked in the Cata-

logue No. 21. The Central Nave of Trimul Naick's Choultry looking east, No. 26 and 27, are also examples of this process, being interior views in the Great Pagoda of Madura. The only other views of interiors in this collection are Nos. 22, 23, 24, 28 and 30 of the Catalogue. These are marked as taken by the wax-paper process, and bear comparison with the dry Collodion pictures of Interiors, but the superiority of definition given by Collodion is very visible when placed side by side with them. Nos. 1, 6, 35, 49 and 50 are good examples of Photographs of Trees especially the two former, No. 35 is an admirable picture giving an excellent likeness of an Umbrella Tree at Trivium. This tree forms an exception to the generality of trees in a photographic point of view, inasmuch as it is so rigid and consequently a good subject for photography which cannot be said of most trees which are so readily blown about by the wind, rendering it extremely difficult to obtain any thing like a good portrait of them, except in the most perfect calm, a rare atmospherical condition even in this latitude. Another interesting natural object in the Collection is No. 16, the Elephant Rock, near Madura, and is certainly one of the best photographs in the Exhibition. The configuration of this rock, named from its resemblance in shape to an Elephant, is admirably delineated, and forms a very striking object to the eye. The most remarkable in the way of architectural subjects are the view of the great Pagoda of Tanjore, and of the Palace in the Tanjore Fort. These are all excellent pictures, being clear and sharp in the minutest details, and in short giving such an idea of the original as photography alone can give. The value of this art is undoubtedly here well illustrated, as views of the most elaborate carving are so accurately copied at once, in a comparatively short operation and which could in no other way be obtained even with the labor of weeks, months, or even years in some cases. Before leaving the consideration of this excellent collection, we must not omit to notice the view of Trichinopoly Rock. It is taken from the west, looking through a gap in the Fort wall, and is an accurate representation of this far-famed object.

Mr. A. Williamson of Calcutta exhibits 26 pictures, 18 being views in the neighbourhood of the City of Palaces, and interesting groups of native figures, the remainder being single portraits. The

former are surpassed by nothing in the Exhibition either as regards manipulation or printing ; indeed they might bear comparison with the best European Photograhs of the day. The tone of these prints is truly admirable, and they almost rival even the finest engravings. This artist especially excels in the delineation of Village Scenes. Those of Kidderpore and Hourah indeed leave nothing to be desired. The accurate and equal focussing of the whole of his pictures up to the very margin, and the admirable distinctness with which the most minute objects are pourtrayed, speak well for the excellent quality of his Lens, and for the process (Collodion) by which these exquisite Photographs have been produced. They certainly surpass in this respect any wax-paper prints we have ever seen. The Silver Medal for landscapes open to all photographers has been awarded to this collection.

The Silver Medal for Portraits open to all photographers was awarded to Lieut. Herbert Macdonald, 35th Regt., his being the best contribution of portraits to the Exhibition. Three other gentlemen Mr. Williamson, Mr. Minchin and Mr. Lafond exhibited portraits, the foremost of whom Mr. Williamson of Calcutta, exhibits 9 of very large size. One of them, a Gentleman in a Highland costume, is an admirable picture, and perhaps the best in the Exhibition, the pose and focussing as well as printing of this picture is excellent, and it would be difficult to find a better photograph of the kind ; as a whole however Mr. Macdonald's collection was considered to surpass Mr. Williamson's. They are all of small size, but very accurately focussed, and well printed, the gradation of tone being remarkably good.

Dr. Pearl exhibits 20 Stereographs taken principally in and about Trichinopoly. These are very meritorious and many of them most interesting and characteristic of the locality, 10 are views of the Palace of Trichinopoly, giving an excellent idea of its present state. There are also two Mussulman Tombs, and a Chuttrum near Madura. The Byragee (No. 2) is excellent, as also the group of Native women with chatties (No. 15). But perhaps the best and most striking picture of this collection is the view of the Pulney Falls, the stereoscopic effect of which is admirable. The Committee recommended a special medal for this collection.

Lieut. Mitchell exhibits 18 Micro-photographs, and at the request of the President, has given the following description of them.

No. 1.—The Parasite of a Goose. This is a member of the order " Anoplura" to which belongs the common louse; it is thus characterized.

" Feet six; wings none; parasitic, and not undergoing metamorphosis; eyes two, simple, or none.

" The order is divided into two sub-orders, the first termed Haustellata, has a mouth with a tubular very short haustellum.

The second sub-order has a mandibulate mouth placed underneath the head, there are five joints in the antennæ, and a double claw to each foot in the Genus Philopterus, to which we believe the subject of our Photograph belongs.

Nos. 2 and 8.—Represent the proboscis of the Blow-fly. The two fleshy lobes of which are kept in a state of expansion, at the will of the insect, by means of the beautiful series of tubes seen in the Photograph and termed modified trachea, this is a very beautiful object for the microscope, and may be very well seen with a good objective of 1 inch focus, but higher powers are required to display the ultimate structure of the tracheal tubes.

No. 3.—The parasite of the common domestic Fowl.

This is an acarus and belongs to the same genus as the cheese mite. It has eight legs, each of which terminates in a double claw and has an acetabulum or sucker. The head is said to be furnished* with two large mandibles, these consist of a soft retractile basal joint, and a second dilated non-retractile joint resembling the fixed claw of a Lobster, and a moveable piece working against the latter, the two last pieces are toothed where in contact with each other; these mandibles can be advanced either separately or together, and can be separated or approximated."

No. 4.—A Butterfly's scale. This is a representation of one of the minute particles of dust that adheres to the fingers when a Butterfly is caught. The wing of a Butterfly consists of a delicate framework of nervures or veins, enclosed between two transparent membranes of great tenuity. To these membranes the scales are attached by the small pedicle or stalk, which fits into a

* Micro-graphical Dictionary.

cup-shaped depression. They are arranged in rows, but the scales composing the row are not uniformly placed. In some Butterflies, each scale overlaps its neighbour by nearly half of its width, like the petals of many flowers. In others the scales are placed side by side without overlapping, but the points of juncture in one row are made to fall upon the middle of the scales of the row beneath. But in either case the several rows overlap each other as slates are made to do on a roof.

A well selected Butterfly's wing is a surpassingly beautiful object when viewed with a moderate power by reflected light, and never fails to call forth the admiration of the beholder. The scales have long been favorite objects with the Microscopist, and the resolution of the ultimate structure of some of them is still among the most difficult feats, the microscope is called upon to assist in. In structure they very much resemble the wing, consisting of an exceedingly delicate framework, and two (some say three) membranes. The scale represented by the photograph is from a small species of Thecla, which are many of them beautifully marked, and may be found in great numbers in the cold season of the year. They fly low, and are easily captured in the morning before sunrise, at which hour they will be found on grass or low shrubs.

When this scale is examined with a sufficiently high power (from 1,500 to 2,000 diameters) it very much resembles an old fashioned window, the delicate framework enclosing a number of hexagonal areolæ, the two opposite sides which form the transverse striæ of the scale, being much longer than the other four sides of the hexagon.

To those who have not seen the minute works of the Creator, as displayed by the beautiful microscopes of the present day; it must seem like jesting to talk of the framework of an atom, the surface of which measures only $\frac{1}{90.048}$th of a superficial inch, and which is quite invisible to unassisted vision, there is, however, sufficient indication in the photograph of its existence, although the power used was only equal to 520 diameters. But these minute hexagonal spaces admit of accurate measurement with a screw Micrometer, and I find that it would require 311, 681, 510

of them to cover one square inch, and that there are about 3,000 of them in one scale.

No. 5.—Is a scale of a slightly different form from the same wing, but magnified 820 diameters.

No. 6.—Is a scale from a small species of Pólyommatus usually found in the same season and locality as the Thecla, scales of this form are by no means common, and so far as I know, are confined to the Polyommati.

No. 7.—The Parasite of a Turkey, though of a very different form belongs to the same order as No. 1.

No. 9.—The house Flea, Pulex irritans, is well known all over the world. Who has not read of trained fleas drawing Ivory carriages in golden harness: or of the enormous leaps they take, equal to 200 times their own length, and which large figure I believe understates the fact. Of the trophi or parts of the mouth however less is known, as they cannot be seen without the Microscope. *The mandibles are two elongated and flattened setæ, with a central rib, and with the †edges finely serrated; these with the lingua which is of equal length but more slender, are united in the middle of the mouth to form an instrument which from analogy with the mouth of the suctorial Hemiptera is probably employed in puncturing the flesh. At rest these organs are defended by the labial palpi which unitedly form a tubular hanstellum. The maxillæ are small, lamelliform, sub triangular appendages at the sides of the mouth, and the maxillary palpi arise from their base at the anterior emarginate extremity of the head." Such is the mouth of the Flea. There are few I fancy who have not at some time or other experienced how well it performs its work.

No. 10.—Represents a part of the mouth of a Wasp, the mandibles and head having been removed for convenience in mounting. The broad blade like organs are the maxillæ. The subjoined organs are the maxillary palpi, that with only four joints is one of the labial palpi, the other being out of sight, the central portion

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*Westwood.

† NOTE—Westwood has overlooked the teeth on the *surfaces* of these pieces, of which there is one, if not two, rows on each side of the central rib. The teeth appear raised like those of a rasp.

covered with fine hairs is the ligula, and the two delicate pieces inserted upon its base are the paraglossæ.

No. 11.—Is part of the wing of a Musquito. The nervures have delicate scales attached to them on both sides of the wing, in addition to which there is a beautiful fringe of larger scales all round the margin. The smaller scales as well as those from the body of the musquito were used as test objects. They require a good glass to show them properly.

No. 12.—Is the mouth of the Larva of the Ant-lion known to young people in India, as the Koolinary. This insect makes a small pit in the form of an inverted cone, in the bottom of which it sits waiting to seize any unfortunate ant or other insect that may fall over the hedge of the pit. But should its victim attempt to escape, the ant-lion immediately begins to jerk out the sand from the bottom of the pit, which not only makes it deeper but increases the steepness of the sides, and the escaping insect is probably hit and brought down again.

The Larva bears no resemblance to the perfect insect, which is very beautiful, and resembles the Dragon flies.

No. 13.—Is a scale from the wing of the Morpho menelaus, a beautiful American Butterfly. It has been long used as a test object. The photograph shows the appearance of the scale when damp has penetrated between the slide and the thin glass cover, as is the case after a short time with nearly all the dry mounted objects received from England, when this has taken place the true structure cannot be made out.

No. 14.—Is a magnified view of a piece of Arnee Muslin, for 8 yards of which 100 Rupees were paid. The irregularity in the size of the threads and the inequality of their distances is very evident. It would have been instructive to have compared a piece of the best English Muslin with this, but I had not time to do so.

No. 15.—Is a Coccus, produced in great numbers in my Library from Lac found upon a Mango Tree in my garden. I believe it is the Larva state of the Insect, but am not certain.

No. 16.—Is the Exuviæ or cast off skin of the Bed-bug Cimex lectularius. The trophi of the Bug consists of a rostrum in which

are imbedded (in a groove) three setæ, two of which are more delicate than the other and serrated at the extremity.

These setæ are only $\frac{1}{7000}$th of an inch in diameter, and near the extremity but $\frac{1}{9580}$th of an inch. It is not a little surprizing how organs of such surpassing delicacy should be able to pierce the human skin. It seems probable however that the blood vessels are reached by way of the sudoriparous ducts.

No. 17.—The foot of a grasshopper, is seen to be furnished with cushions which break the fall of the insect, when it alights after a leaf.

No. 18.—Part of the Exuviœ of a spider.

The mandibles shown in the Photograph are said to be traversed by a canal, terminating at the apex through which the secretion of a poison gland is injected into any thing held between the pointed claws. The mandibles are chiefly used for seizing and holding the prey, which is crushed between the two flat and opposing surfaces of the maxillæ placed just beneath them.

I cannot conclude these brief notes without expressing my regret that the Microscope should be so little used in India. This neglect of a valuable instrument cannot be caused altogether by its expense, because a first class instrument may be bought for the price of a Manton or Purdy, and we see no deficiency of these. Indeed a very trustworthy instrument with which a great deal of work may be done can now be had for from 10£ to 20£.

In England the use of the Microscope is becoming very general, and the following extract from the annual Report of the Society of Arts, London, will go further to show the estimation in which it is held, than any thing I may say.

" The important position which the Microscope now holds, not only in relation to pure, but to applied science, and its great value in assisting to form those habits of observation which it is the object of all sound education to impart, induced the Council to believe that the promoting the production of a good instrument at a price which should render it more readily accessible to the many, was an object worthy of the Society, and accordingly under the advice and with the assistance of a Committee composed of Mr. Busk, F. R. S., Dr. Carpenter, F. R. S., Mr. Jackson, Dr. Lankester, F. R. S.,

Mr. Quekett, and Mr. W. W. Saunders, F. R. S. the following prizes were offered.

" For a school Microscope to be sold to the Public at a price not exceeding 10*s.* 6*d.* The Society's Medal.

" For a teacher's or student's Microscope to be sold to the Public at a price not exceeding 3£ 3*s.* The Society's Medal.

" The Council undertook to purchase 100 of the smaller and 50 of the larger for which the Medals should be awarded.

" The members will be glad to learn that for these prizes there have been numerous competitors. After much caieful examination of all the instruments by the Committee, they unanimously reported to the Council that the instruments sent in by Messrs. Field, & Co., of Birmingham fulfilled all the conditions required, and the Council have therefore awarded to that firm the Medals offered on Messrs. Field and Co., entering into the necessary undertakings to comply with the requirements of the prize list. The Council congratulate the members on this result."

I have examined one of the large instruments referred to in this report, it is an Achromatic compound Microscope, with two object glasses, and two eye pieces with some necessary apparatus. Its performance is unquestionably much superior to the best of the old form of Microscopes, and it has that great convenience a joint to incline the body to any angle, a point in which most of the cheap Foreign Microscopes are deficient, and it is undoubtedly cheap for the money, still I would not recommend any one who could spare more money to buy one of these.

In India people are compelled to look very much to in-door employment during their hours of relaxation, and this is especially the case with Ladies, now I think the Microscope is eminently suited to a Lady's use. The labour is light, and the employment one of surpassing interest. The Microscope makes us acquainted with a world unknown, and if it were possible to fix a limit to creative skill, I should say it had been reached in numerous Microscopic animals and plants.

The Committee recommended a special medal for this most interesting and valuable contribution, probably the first photographs of the kind exhibited in India. They are well printed, and among

the most interesting of the Photographs exhibited. The observations made by Mr. Mitchell, on the Microscope, are well worthy of the attention of members.

Mr. Butcher exhibits 8 excellent views taken in the neighbourhood of Seringapatam the subjects of which are very interesting and characteristic. Mr. Butcher, has proved himself to be a most promising Photographer, but there is room for improvement in his productions, there being too much contrast in the lights and shades, and a deficiency of half tone. It is to be hoped that Mr. Butchers work will be seen in future Exhibitions. Besides the above 20 views which he was good enough to present about a year ago to the Society were also exhibited. The subjects of these are all very interesting. The printing is good and appears to be very permanent, there being as yet no symptoms of fading among them. They have all however the same defect above noted, which we hope to see rectified in the future works of this Photographer. As before stated, the Silver Medal relinquished by Captain Tripe was awarded to this collection.

Captain Dickson exhibits 14 views of the Temple of Bobeneswar. This is undoubtedly an interesting series; but it is to be regretted that several of the pictures show a want of sharpness in focussing, while others are more or less deficient in half tone. This is however a valuable contribution and gives on the whole a good idea of the subjects it represents. Perhaps Captain Dickson's best picture is a view of the large temple with groups of natives in the fore-ground. This is a very characteristic and good picture, being well focussed, and showing greater care in the manipulation, the half-tone at the same time being better preserved than in others of this collection.

Mr. Minchin has sent to the Exhibition 12 Card boards containing a varied and miscellaneous collection of views from nature portraits, groups both European and Native, photographs of Statuettes, and copies of prints. These are all of small size, and have evidently been all taken with a small portrait lens. Nos. 1 and 2, viz., the Pagoda at Coleda near Russelcondah, and a landscape in the neighbourhood of that town, with groups of Sebundies of the Sumbulpore levy in the foreground, are good pictures, as also the

Chittewalsa Sugar Works, and Nos. 3 and 5, especially the latter the bridge on the Roosoocooliah which is a well focussed picture, and indeed for its size one of the most pleasing pictures in the Exhibition. Some of Mr. Minchin's portraits are excellent likenesses, and several of his groups are well posed and artistic. These however are for the most part deficient in half tone, and some of the prints begin to show indications of fading. Mr. Minchin's best pictures are undoubtedly his copies of prints, a branch of the art which is perhaps too little followed; Nos. 28, 29 and 30 are particularly good.

Captain Barwise exhibits 12 Collodion views of the seven Pagodas and neighbourhood. These are further stated to have been taken by the Honey process. The subjects of this contribution are highly interesting; they are generally speaking well selected, and display a good gradation of tone. These prints, however, evidently do not give sufficient justice to the negatives from which they have been taken which is much to be regretted, as so far as can be judged from them, the latter cannot be otherwise than excellent—indeed had the printing been good Captain Barwise would no doubt have stood a good chance for the gold Medal. All of these prints before they were even placed in the Exhibition had begun to give indications of fading, and some of them are now rapidly disappearing. In the whole of them, the skies are of a deep yellow or cheesy color, No. 1, 2, 3, 4 and 12 would have been very good pictures but for the defect above observed. The village scenes especially are excellent in an artistic point of view. The Committee hope that Captain Barwise will, on a future occasion, adopt another printing process instead of the one he has hitherto employed, when no doubt his pictures will bear comparison with those of most Photographers in this country.

His Excellency Sir Charles Trevelyan, exhibits 13 Views and Portraits of Aden and the inhabitants of the neighbourhood of that station. These are published by Captain R. L. Playfair, First Assistant Political Resident at Aden, and on the back of each picture is a short printed explanation. The views four in number have little to be desired. They have evidently been taken by the Collodion process. They represent the main pass or Babel Zeman

as it is called by the natives ; a view of the town of Aden, the Mosque of Nidroos, and the Baman temple. These are all admirably clear and sharp, the minutest details being well delineated, and they convey an excellent idea of the interesting objects they represent. In the view of Aden especially, the peculiar volcanic character of the surrounding rocks is beautifully brought out, the half-tones of these pictures are excellent. The portraits though not carefully manipulated are still highly interesting. Those representing the Somalie Warrior and Somalie female are perhaps the best. The aval of Braheran is also good.

Four views of some of the principal objects in Madras, were exhibited by Lieut. Mitchell, as also five views by Dr. Scott ; these prints were exhibited solely to show the results obtained by the new toning process with Alkaline Chloride of Gold which bids fair to supercede all former methods. Instead of Citric acid as recommended by Mr. Hardwick, Lieut. Mitchell employs lime juice. Dr. Scott used nothing else but Carbonate of Soda and Chloride of Gold. Perhaps it may be advantageous to use the acid with the view of preventing the too rapid toning of the picture, and the risk thereby of its being destroyed by the blue tinge it acquires under these circumstances. The advantages of this process over the sel d'or is that it is not necessary to be carried on in a dark room. That it is much less complicated and that it gives much better results, any depth of tone may be given from brown to black, while the whites of the picture are well preserved, and the risk of yellowness of the skies greatly diminished. The Committee cannot close this report without bringing this process prominently to the notice of all Photographers throughout the Presidency.

Bangalore, 8*th August* 1859.

My Dear Scott,

I have received your letter of the 5th Instant, informing me that the Committee appointed to adjudicate the Medals of the late Photographic Exhibition at Madras, have awarded me the Silver Medal for views and landscapes open to all members of the Society, and you further say that, had I been considered an Amateur, the Gold Medal would have been awarded me.

This flattering notice of the Committee upon my contribution is an ample award, and I am perfectly satisfied with the view taken by the Committee, as to my position as a Photographer. I cannot be considered an Amateur, while I am Government Photographer. And more than that, the advantages I possess in that position are so greatly in my favor both as to the variety and number of subjects I can exhibit compared with the other members of your Society that I do not feel justified in accepting the Medal awarded me. I therefore beg you will make my best acknowledgments for it to the Committee, and replace it at their disposal elsewhere. In doing this, I beg to say, that my not having from the first disclaimed the intention of receiving any medal, if I should be so fortunate as to have one awarded me, is a proof of the value I set on a favorable report of your Committee.

Your's very sincerely,

(Signed) L. TRIPE.

List of Photographs exhibited bg CAPT. GIRDLESTONE, 11*th Regiment N. I.—Gold Medal.*

Nos.

1. Telegraph in the Wynaad Jungle.—Collodion Albumea Process, Mr. Hardwick's Formula, (untouched.)
2. A Bye Lane, Cannanore—same as above, (untouched.)
3. The Fort Ditch, Cannanore—same as above, (untouched.)
4. The Arsenal Cannanore—same process as above, (Papier Saxe plain salted, (untouched.)
5. A Sketch Cannanore—same as above, (untouched.)
6. The Tellicherry Road—same as above, (untouched.)
7. The Juma Musjid Cannanore—same as above, (untouched.)
8. The Backwater Billapatam—same as above, (untouched.)
9. A Moplah Musjid—same as above, (untouched.)
10. The Bellapatam road—same as above, (untouched.)
11. Tier Sawmy Houses—same process as above, Albumenised Paper, (untouched.)
12. A Saw Pit Cannanore—same as above, (untouched.)
13. The Parsonage—Dry Collodion Process—Dr. Morris' Plain paper, (sky touched.)

List of Photographs exhibited by Capt. Tripe—*Silver Medal.*

Nos.		
1.	Tree near Royacottah.	Wax Paper.
2.	Edgah and Tomb Royacottah.	do.
3.	Royacottah Hill from S. W.	do.
4.	Royacottah Hill Fort Gate.	do.
5.	Royacottah Hill Fort S. S. E. from inside Fort Gate.	do.
6.	Seringham Pagoda Gateway S. Side.	do.
7.	Hierd Gopurum on the S. Side Seringham Pagoda.	do.
8.	Half Front of the Shashanary Anasawmy Mundapum.	do.
9.	Seringham Jumboogashwaram Pagoda view between outer enclosure and 1000 pillared Mundapum.	do.
10.	Trichinopoly Bridge over the Cauvery	do.
11.	Trichinopoly Ghaut near S. end of the Bridge.	do.
12.	Trichinopoly Rock from N. looking through a gap in the Fort Wall.	do.
13.	Trichinopoly entrance to the Pagoda on the rock looking outwards.	do.
14.	Trichinopoly street leading to the Fort from Cantonment.	do.
15.	Trichinopoly Musjid of Nutter Owleah	do.
16.	Elephant Rock near Madura.	do.
17.	Causeway across Vygay River near Madura.	do.
18.	Madura Base of one of the Monoliths in the Rajah Gopurum.	do.
19.	Madura West Front of the Poodoo Mundapum or Trimul Naick's Choultry. ..	do.
20.	Madura East Front of the Poodoo Mundapum or Trimul Naick's Choultry. ..	do.
21.	Madura Trimul Naick's Choultry central nave looking E.	Dry Collodion.

Nos.		
22.	Madaru Trimul Naick's Choultry side aisle looking E.	Wax Paper.
23.	Madura Trimul Naick's Choultry entrance to central nave from West Portico.....	do.
24.	Madura Great Pagoda Veeravasanta Raja's Mundappum.	do.
25.	Madura Great Pagoda 16 pillared Mundappum near 1000 pillared.	do.
26.	Madura Great Pagoda 2d Pracarum W. Side.	Dry Collodion.
27.	Madura Great Pagoda 2d Pracarum N. Side.	do.
	Three Vahanvums (Carriages for the gods) place in view.	do.
28.	Madura Great Pagoda Vista through two Mundappum.	Wax Paper.
29.	Madura Palace, Mr. Fisher's School in foreground.	do.
30.	Madura Palace, arcade or quadrangle.	do.
31.	Madura Palace, Session Court Room.	Dry Collodion.
32.	Madura Summit of Secundra Mallai Hill.	Wax Paper.
33.	Trimum small Hill Fort from N. N. E.	do.
34.	Trimum Hill Fort Walls from inner Gate.	do.
35.	Trimum Umbrella Tree.	do.
36.	Tanjore Part of the Palace in the Fort.	do.
37.	Tanjore Palace on side of quadrangle in Gentoo.	do.
38.	Do. do. quadrangle Rajah Sevajie's Station.	do.
39.	Do. do Rajah Sevajie's Station.	do.
40.	Do. Great Pagoda Bull.	do.
41.	Do. do. do. Buramum from near entrance.	do.
42.	Do. do. do. Basement of the Buramum from W.	do.

Nos.		
43.	Tanjore Palace, entrance S. Side to Buramum	Wax Paper. do.
44.	Do. do. do. view by N. side of the do.	do.
45.	Do. do. do. Soobarahmana Sawmy's Court.	do.
46.	Do. do. do. Part of S. Facade of do do	do.
47.	Do. do. do. Soobramanah Sawmy's Court, sacred waters from a cistern	do.
48.	Do. do. do. a view looking down one side of outer wall and arcade.	do.
49.	A view of Banyan Tree near Admancottah.	do.
50.	Tree (on the Road Side) near Royacottah.	do.

List of Photographs exhibited by Mr. WILLIAMSON *of Calcutta.— Silver Medal.*

1. Kidderpoor, Calcutta 1859.
2. Kidderpoor Donghas, or a sort of Canoe scooped out of the solid Palm, Calcutta, 1859.
3. Tollahs Nulla, Calcutta, 1859.
4. Bengalee at Chetpoor Road, 1859.
5. The Fogapour Town in Alipoor, 1859.
6. Tollah's Nulla, 1859.
7. Hourah, 1859.
8. Hourah, 1859.
9. Baghbayar Street, 1859.
10. Chinese Gorusthan, 1859.
11. Native Bandy, 1859.
12. Kidderpoor, 1859.
13. Rajah of Assam's servant. Three Rajahs of Cochan and Assam, 1859.
14. Chota Hazree at the Gloom, 1859.
15. Six Portraits, viz.:
    1. A Sikh, one of the most notorious Dacoits who infested Bengal.

Nos.

2. A Sikh, one of the defenders of Arrah imprisoned at Allipoor for 2 years, for having eloped with a Native Non-Commissioned Officer's wife.
3. A Thug imprisoned for 30 years.
4. A notorious Burmese Dacoit imprisoned for life.
5. A Sepoy of the 43d Regiment imprisoned for desertion.
6. A Fakeer found tampering with the Sepoys at Barrackpoor.

16. Burmese Murderer and Convict.

17. to 24. Portraits.

25. A Village Scene near Kidderpore.

26. A Cargo Boat at Ghoosery.

Photographs exhibited by HERBERT MACDONALD, ESQ., *35th Regiment.—Silver Medal.*

A Frame of Portraits and copies of Engravings.

List of Photographs exhibited by Lieut. J. MITCHELL—*Silver Medal.*

VIEWS.

No. 1.	The Munro Statue, Mount Road.	Negatives on unwaxed paper, No. 4 untouched. The skies of Nos. 1, 2 and 3 deepened with Indian Ink. All toned by Hardwick's new Alkaline process Chloride of Gold.
2.	The College Bridge.	
3.	A view at Mamullaipoor (The Seven Pagodas.)	
4.	Doveton House, The residence of Sir P. Grant.	

Negatives taken with the Achromatic Compound Microscope.

No. 1.	Proboscis of Blow fly,	Magnified	484	times.	The Negatives were taken by the Collodion process and are untouched. The proofs were toned by Hardwick's new Alkaline Chloride of Gold process.
2.	Parasite of Tame Goose,	,,	484	,,	
3.	Parasite of Fowl, an Acarus,	,,	3·969	,,	
4.	A Butterfly's scale (Thecla)	,,	276·676	,,	
5.	,, ,, ,,	,,	672·400	,,	
6.	,, ,, Polyommatus	,,	276·676	,,	
7.	Parasite of Pig,	,,	484	,,	
8.	Proboscis of Blow fly	,,	1·600	,,	
9.	House Flea,	,,	484	,,	

Nos. 10.	Trophi of a Wasp,	Magnified	484	times.
11.	Wing of Musquito,	,,	484	,,
12.	Mouth of Larva of Ant Lion	,,	484	,,
13.	Scale of Morpho Menelaus,	,,	72‘900	,,
14.	Arnee Muslin at Rs. 12½ per Yard,	,,	2·500	,,
15.	Coccus Lacca from Mango tree,	,,	2·500	,,
16.	Exuvia of Bed bug showing Lancets,	,,	484	,,
17.	Tarsus of a Grasshopper,	,,	484	,,
18.	Exuvia of a Spider shewing the Jaws,	,,	484	,,

The Negatives were taken by the Collodion process and are untouched. The proof were toned by Hardwick's new Alkaline Chloride of Gold process.

List of Stereographs exhibited by Dr. Pearl.—*Silver Medal.*

Nos.

1. Pulney Falls.
2. Byragee.
3. Chuttrum Madura.
4. Trichinopoly entrance to Palace.
5. Trichinopoly Palace.
6. Do.
7. Do.
8. Do.
9. Do.
10. Do.
11. Do.
12. Do.
13. Do.
14. Mussulman Tomb.
15. Native woman with chatties.
16. Trivellipotoor.
17. Mussulman Tomb, Trichinopoly.
18. Tree Fern Pulney Hills.
19. Group of Officers.
20. Do.

List of Prints exhibited by Mr. Butcher.

No. 1. Mausoleum of Hyder Ali and Tippo Sultan.

2. The Wellesly Bridge on the Northwest of the Fort of Seringapatam.

Nos.

3. Pagoda at Munjengode near Mysore.
4. View of Pagodas at Munjengode.
5. Bathing Place of his Highness the Rajah of Mysore.
6. The Durga Howbert—formerly a Palace of Tippoo Sultan, and after the taking of Seringapatam, the residence of the Duke of Wellington.
7. View of part of the interior of the Fort of Mysore.
8. View of a ruined temple in the vicinity of Hallabeed.

List of Photographs exhibited by Capt. H. DICKSON, 22*d Regiment N. I., Cuttack.*

VIEWS AT BABENESWAR.

No. 1. The large Temple.
2. The Singh Durwazah or Lions Gate of the above.
3. A curious tank to the East of the great temple surrounded by seventy or eighty small temples.
4. Group of Temples to the west of the great temple.
5. The Baital Temple.
6. The Mookteswar Temple and Idols Swing.
7. A Glade near the above, with Temples and Ruins.
8. The Temple Annuntoo Basu Devya on the large Tank Bindoo Sagur (evening.)
9. The Temple Pursaram Iswar.

VIEWS AT THE ROCK CUT CAVES.

10. } Views of the large Cave at Oodyajhoiri, Called the Palace of
11. } Sudra Resari or "Ranee Goompah."
12. The Ganesa Cave, Eodyaghini, said to be the most ancient and dating about 200 B. C.
13. The Hill of Khundaghiori, with Modern Jain Temple from Oodyaghirri.

VIEWS AT JUGGERNAUT POOREE.

14. Views of the Great Temple of Juggernaut, showing the Lions Gate and beautiful Monolitho.

List of Photographs exhibited by Mr. MINCHIN.

Nos.

1. Pagoda at Coloda near Russelcondah.
2. Landscape at Russelcondah, Sebundies of the Sumbulpore Levy, in undress in the foreground.
3. The Engineer's Camp near Aska.
4. The Wead leaf Moth (Russelcondah.)
5. Bridge on the Roosoocooliah, Aska.

6. 7. 8. } Three views of the Aska Sugar Works so taken as to form an entire picture.

9. The Chittiwalsah Sugar Works from the South Gate.
10. Old Dutch Burial Ground at Bimlipatam.

11. 12. 13. 14. } Portraits from Life.

15. 16. 17. } Do. do.

18. Dressing a Bride (from life.)
19. Portrait of an Infant (do.)
20. Chess (do.)
21. Group of Ladies (do.)
22. Bagatelle (do.)
23. Native Goomoostahs weighing Jaggery (from Life.)
24. „ Coolies packing Sugar (do.)
25. Views from a bronze Statuette.
26. Milton's "Sabrina" from a Statuette in Parian.
27. The Greek Slave, do do.
28. "The Queen's Horses" from an engraving in the Art Journal.

List of Photographs exhibited by CAPTAIN BARWISE, 45*th Regiment N. I.*

Nos.

1. The Seven Pagodas North view.
2. Do. South view.
3. Palmyra Trees.

Nos.

4. The Village of Moulaveram.
5. The Pagoda at Moulaveram.
6. A Village Scene.
7. Part of the Rock at Moulaveram.
8. Do. do. do.
9. Pagoda on the Rock at do.
10. Choultry at do.
11. Palmyra Tope.
12. A Village Scene.

List of Photographs exhibited by Mr. WILLIAMS, *of Calcutta.*

Princeps Ghaut, Calcutta.
Mosque Corner of Danramell, Calcutta.
La Martiniere, Calcutta.
Harding's Statue, do.
Naughty Dog.
The Hugenot.
The Proscribed Royalist.
Town Hall, Calcutta.
Mosque South Colingher, Calcutta.

Captain Playfair's View of Aden—Contributed by His Excellency Sir CHARLES TREVELYAN.

Mosque of Ardross.
Banian Temple.
Main Pass.
Parsee.
Hindoo of Purva Caste.
Arab of Baherain.
Somalie Female.
Sultan Fardthel Bin Mohsin.
Somalie Warrior.
Khadim.
Syed Mahomed bin abod Rahenamel Jifferee.
View of Aden.

List of Photographs exhibited by Dr. Scott.

Nos.		
1.	View of Government House and Banqueting Hall	Waxed Paper.
2.	View of Government House	do.
3.	View of his own house	do.
4.	View of St. Andrew's Church	do.
5.	View of Cathedral	do.

Proceedings of a Meeting of the Photographic Society, *held at the School of Arts, on Thursday, the 2d June* 1859.

Present.

Dr. Duff in the Chair.

Col. McCally.
The Hon. Mr. Elliot.
Mr. Newill.
Mr. Nicholas.
Mr. Underwood.
Lieut. Mitchell, and
Dr. Scott.

Read a letter from Dr. Flynn, intimating the receipt of 14 Photographs sent to him for Exhibition by Captain Dickson, 22d Regiment N. I.

It was put to the Meeting whether these pictures should be received and admitted to compete for the Medals.

Resolved, that under the circumstances this should be allowed.

Resolved, that the Committee for the adjudication of the Medals should consist of the following gentlemen :—Mr. Nicholas, Col. McCally, Mr. Cole and Dr. Scott, with Mr. Underwood as Chairman.

Resolved, that 100 copies of the Photographs intended for distribution for the year 1858-59 be ordered from England, and that they should have printed labels affixed to them.

The following gentlemen were proposed and elected Members of the Society :—Dr. Macpherson and Dr. Maclean.

At the ordinary Monthly Meeting of the PHOTOGRAPHIC SOCIETY, *held at the School of Arts, on the 4th July*, 1859.

The report of the Committee appointed to adjudicate the Medals to be given to the successful competitors at the late Exhibition was read and approved of, and it was further resolved that it should be printed for distribution to all members of the Society. The Committee consisted of the following gentlemen:—

W. E. Underwood, Esq., *President.*

Colonel McCally,
Messrs. Cole,
,, Nicholas, and
,, Scott. } *Members.*

The Medals were awarded as follows:—

A gold medal for views and landscapes, open to all Amateur Members of the Society—

To Captain Girdlestone, 11th Regiment N. I.

A silver medal for views and landscapes, open to all Members of the Society—

To Captain L. Tripe, 12th Regiment N. I.

A silver medal for views and landscapes, open to all Photographers—

To Mr. Williamson, of Calcutta.

A silver medal for portraits open to all Photographers—

To Lieutenant H. C. Macdonald, 35th Regiment N. I.

In addition to the above, the Committee recommended that special silver medals should be awarded.

For Micro-photographs.—To Lieutenant J. Mitchell.

For Stereograms.—To W. Pearl, Esq.

It was resolved, that the recommendation of the Committee should be confirmed.

Lieutenant Mitchell read a most interesting communication, giving a history of the rise and progress of Micro-photography, with a full detail of his own method of manipulating. It was resolved that this valuable paper should be printed in an Appendix to the Report.

By the kind permission of Mr. Garrett, Dr Scott exhibited the new Stereoscope patented by Mr. George Colleton Cooke and manufactured by Messrs. Nagretti and Zambra of Cornhill. This is the most perfect instrument of the kind which has been as yet produced, and possesses the following advantages. The eye pieces are fitted into trumpet-mouthed tubes by which arrangement the eyes are protected, the field of view is increased, and larger lenses than usual can be employed—therefore less impediment than heretofore is offered to the rays emanating from the picture, and the eye of the observer is enabled to range more fully over the field of view. In this new form of Stereoscope we have also the adaptation to the eye piece of additional moveable lenses adapted to different kinds of sight. These lenses are either meniscus, concave, plano, convex or double convex as may be required, and they are adapted to the instrument in such a manner that they are moved into and out of use by small levers projecting through the sides of the box. The only objection to this Stereoscope is that it is expensive, the English price being £6-6. It is fixed on a very substantial stand which renders it steady, and by an arrangement of brass cylinders contained one within the other it can be elevated or depressed between 2 and 3 feet, so as to suit the convenience of those using it either when sitting or standing.

Those interested in Stereographic art who can afford it, ought certainly to provide themselves with this instrument as the most complete and perfect of the kind now obtainable.

Agricultural and Horticultural Society.

Proceedings of a Meeting of the Committee, held on Wednesday the 6th April 1859.

Present.

Hon'ble Sir A. Bittleston, Kt., *Vice Patron.*

Hon'ble W. Elliot, Esq., *President.*

Colonel A. McCally,
J. Rhode, Esq.,
C. Dale, Esq.,
H. F. C. Cleghorn, Esq. M. D.,
R. Hunter, Esq.,
R. D. Parker, Esq.,
Col. F. A. Reid, C. B.,
H. B. Montgomery, Esq. M. D., *Secretary.*

The Secretary informs the meeting, that the proceedings of the last monthly meeting. were so incomplete, that it was not deemed advisable to give publicity to them, until the lists then prepared were corrected and approved. The proceedings of the two meetings are therefore recorded in those of this date.

It is determined that, in order to enable intending exhibitors to make the requisite preparations for the Annual shows, lists of prizes for each show shall as far as possible be prepared and published immediately, after the preceding Exhibition : so that 10 or 11 months will be thus allowed for Exhibitors to prepare for the competition.

The Committee hope by this, and by the arrangements proposed, a decided success may be expected on every occasion.

The Committee proceed to examine the account of the late Exhibition wherefrom it appears that the receipts amounted to Rs. 686 and the expenditure to Rs. 675, leaving a balance of Rs. 11 to be carried to the credit of the Exhibition Fund for 1860.

The Committee resolve that the best thanks be recorded to Colonel Colbeck, J. T. Maclagan, Esq., Dr. Montgomery and Mr. Brown, who formed the Committee of Management of the last show.

Resolved also, that Messrs. Ashton, Richardson and Co., and C. Appoocoottee Pillay and Co., be similarly thanked for their gratuitous loan of Articles required by the sub-committee.

Resolved also, that the Quarter Master General and Commissary General of the Army be thanked for the use of the Tents and Tables required on the same occasion.

The Police placed at the disposal of the Sub-Committee were most diligent in the discharge of their duties, and Col. Boulderson is requested to accept the thanks of the Committee for the admirable arrangements made by them to prevent any disorder.

Read the following letter from H. Cleghorn, Esq., M. D., Conservator of Forests—To H. B. Montgomery, Esq. M. D., Secretary Agri-Horticultural Society.

Sir,—Amongst other places visited during my late tour in the Northern Circars, was Aulapilly 24 miles South West from Vizagapatam, situated in a fertile part of the district, near enough to the Vindyan range of Hills, to derive advantage from the proximity.

The Hon'ble W. Elliot had formerly mentioned the existence of an interesting garden here, containing many exotics received from the H. C. Botanic Garden, Calcutta, and as Mr. T. Knox, principal assistant to the Government Agent, wished me to see it, I diverged from the usual route for that purpose.

On the 4th instant, I spent some hours in this remarkable garden and being much gratified with my visit, I beg to enclose the list of plants supplied by Dr. Wallich to the deceased proprietor, with a few remarks as to the plants which have succeeded and those which have died; the Garden Gomashta showed me the different trees, and generally named them correctly. It was not possible during my short visit to note the numerous varieties of Fruit Trees, (Mango, Guava) which at the time were just coming into blossom, but I may mention that I saw five species of the orange family, which I was told fruited freely, as well as the Litchi, Akee and Sapodilla, the first of which has never succeeded in the Society's Garden, Madras.

I saw a number of seedling Fruit Trees and Graft Mangoes, which were ready for delivery to friends of the family.

I was much struck by a fine specimen of *Uraria Odorata*, the only one I have seen south of Calcutta, and by the size of the Cyaputti and Mahogany Trees, which are much larger than we have in Madras. The *Melaleuca Leucadendron* flowers and fruits abundantly and attains a girth of 2½ or 3 feet. One Mahogany tree was

nine feet in circumference, a foot above the ground. It perfected its fruit some years ago, but has not flowered for several seasons.

I venture to consider the proprietor of this garden deserving some mark of approbation at the hands of your Society, and I think that such a mark forwarded through the Government Agent (Mr. Reade) would have a good effect in encouraging some of the intelligent zemindars of the Northern Circars to follow the example set. I hope the Committee will not think it amiss in my recommending that a Silver Medal and certificate be given to the family of Surya Prakasa Row. I have reason to believe that it would be greatly valued. The certificate might allude to the perseverance of the proprietor in personally watching the progress of the trees in various stages of growth, and arrangements might be made for reciprocating parcels of seeds.

I have the honor to be, &c.,

(Signed) H. CLEGHORN,

Conservator of Forests.

Madras, 24th March 1859.

Resolved, that a Silver Medal and Special Certificate be presented to the family mentioned by Dr. Cleghorn, and that publicity be given to this communication in the "Dina Vurthamani" and through collectors who are to be requested to give publicity to the letter and its results in the Local Gazettes.

Read Extract from a letter from Dr. Cleghorn offering to obtain sets of Gardening tools, if desired by the Society.

Resolved, that Dr. Cleghorn be requested kindly to order a selection of Garden implements which the Committee trust may serve as models. Articles of this kind are much needed by Madras Gardeners.

Read a letter from Colonel Reid, C. B., suggesting the dispatch of a case of plants to the Gardens of the Right Honorable the Governor of Bombay.

Resolved, that this suggestion be immediately acted upon.

Read a letter from the Hon'ble Sir Charles Trevelyan received with some "Ife" plants and containing the following Extract of a letter from Sir W. Hooker.

" I desire very much to send out to Madras a new Plant I have lately imported from Angola—the " Ife" or Sansieve a Cylindrica. It is highly valued in that part of Africa, where the Portuguese manufacture from its fibre, admirable cables and cordage for their Dock-yards :—and this fibre is now found to be the best for deep sea sounding, on account of its strength and pliability. I would ask you if you would kindly take out two or three plants for Madras, where I am sure they would succeed well and soon increase."

Resolved, that the thanks of the Society be conveyed to Sir W. Hooker for his donation, and to Sir C. E. Trevelyan for his kindness in bringing the plant to Madras.

Resolved also, that His Excellency the Honorable Sir C. E. Trevelyan be requested to accept the office of Patron to this Society, vacated by the departure of the Right Honorable Lord Harris.

Resolved also, that the cordial thanks of the Committee be conveyed to the Right Honorable Lord Harris, for the great interest invariably exhibited by him in the success of the Gardens, and for his frequent and valuable contributions to the collection of the Society.

Resolved, that the following seeds be obtained from England for distribution to Members of the Society in the course of the present year under the usual arrangements. (This list is not published in consequence of its length, but copies of it will be forwarded to all Members of the Society, and may be obtained gratis from the Superintendent at the Gardens, or from the Secretary at his residence.)

Resolved, that all packets of seeds not required by Members are to be disposed of to the public generally at a moderate charge, and that application for them may be registered by the Superintendent at the Gardens.

The Committee having reason to believe that the existence of an entrance fee, prevents many persons from becoming Members of the Society, it is

Resolved, that the entrance fee of 10 Rupees shall be abolished. This rule to have effect from and after 1st April 1859, subject to the confirmation of the next General Quarterly Meeting to be held on 2nd Wednesday in July.

The Committee observe that the General Meetings of the Society as ordered in para. 23 of the Regulations, have not for the past few years been regularly held, but their revival seems desirable as affording to the Members generally an opportunity of becoming acquainted with the practical working of the Society and its progress.

The following gentlemen are unanimously elected as Members of the Society. G. L. Nursinga Row, Esq., R. S. J. Prendergast, Esq., Captain A. H. Hope, T. Franck, Esq., E. R. G. Fane, Esq., Major Black, M. A., and Capt. J. G. Palmer, 15th Regiment N. I.

Business not being concluded at 8½ o'clock A. M.,

The Meeting was adjourned to 20th instant at the usual hour.

Proceedings of a Meeting of the Committee held on Friday, 6th May, 1859.

PRESENT.

Colonel Reid, C. B.,
H. F. C. Cleghorn, Esq., M. D.,
Colonel McCally,
A. J. Scott, Esq., M. D.,
R. Hunter, Esq.,
H. B. Montgomery, Esq., M. D.,

Read the following, which has been referred to the Society by order of Government.

Extract from the Minutes of Consultation, under date the 10th February, 1859.

Read the following letter from Surgeon EDWARD BALFOUR, Officer in charge of the Government Central Museum ; to T. PYCROFT, Esq., Chief Secretary to Government Fort Saint George, dated 8th February 1859, No. 41.

SIR,—The Members of Government are, I believe, aware that Mr. R. Fortune is now for a fourth time in China, to gather for the United States, supplies of plants suitable for introduction into the Union.

2. I observe it stated in the Proceedings of the Anniversary General Meeting of the Agricultural and Horticultural Society of

India, held on the 12th Ultimo and reported at page 214, Volume II, No. 44 of Calcutta *Indian Field* Newspaper, that the Society has re-opened communication with Mr. Fortune, who has promised to obtain seeds and plants in China for the Society.

3. Although Mr. Fortune in his second and third visits to China (see Ag. Hort. Soc. of India's Proceedings for 1854 and 1855) sent to Calcutta many valuable plants and seeds, this part of India does not seem to benefit by such acts. Of the rarer and finer tea plants of undoubted value, which he introduced amongst the Southern slopes of the Himalayas, I have not learned that even one variety has ever been brought to our mountains, and of the valuable and famed Green Dye Plant of China, a large stock of which is available in the Calcutta Society's Gardens, the Madras Presidency has none.

4. I have written on the last subject to the Board of Revenue, but address Government on the advantages of some Body or Board opening a communication with Mr. Fortune, on behalf of this Presidency.

True Copy,
(Signed) T. PYCROFT.

With reference to the foregoing, the Committee regret that, as all experiments upon Tea should be cultivated in a latitude very different from Madras, it is entirely out of their power to conduct under their own observation any investigation into the possibility of propagating this useful plant. But fully recognizing the desirability of its introduction into Southern India, they consider that the matter is well worthy of the attention of the cultivators whose estates are situated on the slopes of the Neilgherries and in the Wynaad. They therefore direct that copy of this letter and of their proceedings to-day be despatched to the Planters' Association in the Wynaad, and to such gentlemen as cultivate large tracts of land in these districts. It is further resolved that, should any Gentleman be anxious to make trial of the Tea plants from China, this Society will be glad to assist him in procuring plants.

As concerns the Green Dye, it is resolved, " That a letter be despatched to A. H. Blechynden, Esq., Secretary of the Agri-Horticultural Society of India for some plants of the green dye plant (Ruellia) of China for culture in these gardens. The Committee

will report upon the result of this experiment for the information of Government to whom a copy of their proceedings are to be forwarded after publication."

The Secretary intimates that three casks of the New Orleans Cotton Seed has been forwarded to the Revenue Board for distribution in the provinces. The whole of the Cotton seed received from the Manchester Association has been thus transferred to the Revenue Board with the exception of two casks, which still remain available for the Members of the Society should they desire to test the possibility of propagating this species of Cotton.

Read letter from Major Worster, Barrack Master Fort St. George, intimating that it is the wish of the Honorable the Governor that the lines of the Native Infantry Regiment at Perambore should be planted with Portia and other trees, and requesting the co-operation and assistance of the Society in carrying out His Excellency's views.

The Committee observe that the present weather is not suited to the successful planting of slips of the Portia trees, and they have, since the receipt of the foregoing letters learnt, that the lines in question have been supplied from another source with Seedling plants in sufficient numbers—but as it is not unlikely that further requisitions of the same nature may be made upon them by Government or by private individuals, they determine in anticipation of such requirements to devote a considerable portion of the new ground to the formation of a tree nursery, and further direct that 1,000 Portia trees be raised from seeds in the present garden with the least possible delay.

The Secretary intimates that the Seed Bills due to Messrs. Carter and Co., have been paid and orders have been despatched for the transmission from England of the Annual Supply of Flower and Vegetable Seeds—lists of these will be circulated to all the Members of the Society and distributed *gratis* to any persons anxious to obtain them.

Resolved that the next meeting take place on Wednesday June 8th at 6. A. M.

WALTER ELLIOT, *Chairman*,
HOWARD B. MONTGOMERY, M. D., *Secretary*.

Proceedings of a Meeting of the Committee held at the Gardens on Wednesday, June 15th, 1859.

Hon'ble W. Elliot Esq.,	A. Scott, Esq., M. D.,
Colonel McCally,	H. B. Montgomery, Esq., M. D.,
R. Hunter, Esq.,	*Secretary.*
Colonel Colbeck,	

The Secretary submits to the Committee the following printed notices, (1) of the Plants available at the Gardens, (2) of the consignments of Seeds for 1859 and (3) of the lists of Prizes proposed to be given at the next annual show at the Gardens, intended to be held in February 1860. A copy of the list of Members of the Society and the Rules and Regulations of it is also submitted.

Copies of these two Pamphlets have been distributed to all Members of the Society.

Resolved that copies of these are to be also sent to all persons requiring information, to all Gentlemen arriving at Madras, and to all persons who applied for Seeds last year. They may be had at the Gardens from the Superintendent, gratis.

Read the following—

Chamber of Commerce, Madras 25th May, 1859.

To H. B. Montgomery, Esq., M. D., Secretary Agri-Horticultural Society, Madras.

Sir,—By desire of the Chamber of Commerce, I have the pleasure to transmit copy of a letter from Mr. Thwaites, the Director of the Botanic Garden at Paradenia, Ceylon, to Mr. Goldingham, M. C. S., on the subject of improving the indigenous Cotton of India.

This communication will no doubt prove of interest to your Committee.

I have the honor to be Sir,
Your most obedient servant,
H. Nelson, *Chairman.*

Paradenia, Ceylon, 24th March, 1859.

My dear Sir,—I am glad to hear that a decided effort is to be made to give an impetus to an extensive cultivation of Cotton, for the English Market, in the Madras Presidency, and I trust it will be attended with every wished for success.

It has occurred to me, as there would probably be some difficulty in getting the superior descriptions of American Cotton acclimated in any moderate space of time, that attempts to improve the Native Cotton are well worthy of consideration, and I would suggest that systematic experiments should be made of crossing the native kinds with the "Bourbon," "Sea Island," and "New Orleans" varieties. In conducting the operation the same plan should be adopted and the same precautions observed that are taken in crossing valuable flowers and fruits, with such signal success, in Europe. An intelligent, active and conscientious person should be employed, who would give the experiment a fair trial: for, if the result should be the obtaining a variety of Cotton—hardy, prolific and of superior staple, the benefit would be almost incalculable; whilst, if the experiment should not end in so favorable a manner as could be desired, a problem of very great interest would have been solved, as to the affinity the several varieties of Cotton bear to one another.

The following is the plan I should recommend being adopted in carrying out the experiment.

A moderate number of each of the several varieties of superior Cotton should be planted and carefully cultivated; each kind being kept separate. The Native Cotton should be planted in a certain number of rows, and of so many of these rows all the plants should have their flowers crossed by one description of superior Cotton;—the plants of so many other rows by another description of superior Cotton, and so on:—and each flower, when crossed, might be marked by a small piece of coloured twine being tied to its stalk.

The ripe seeds obtained from these crossed flowers should be sown in distinct patches,—that is to say—those resulting from the cross with the "Bourbon" in one place, those from the "New Orleans" in another, and so on for the rest.

When the plants raised from these seeds come into bearing, a great diversity would probably be exhibited by them respectively, as regards healthy appearance, prolificness and the quality of the staple. The inferior ones should be pulled up and thrown away, and the better kinds retained and numbered, and their comparative qualities well examined and recorded.

If it should be found that real progress had been made towards improvement of the Native Cotton, the system of crossing might be still further carried on, using the plants of the already improved stock, instead of those of the original Native kind, for crossing upon: and this operation might be carried on for several generations of plants until the maximum improvement should be considered to have been realised.

Believe me, &c.,

(Signed) G. H. THWAITES.

To J. GOLDINGHAM, ESQ., &c., &c.

The Committee consider the foregoing proposition as exceedingly ingenious and likely to prove a means of improving Native Cotton, so as to produce from it an article of good staple.

In recording their thanks to the Chamber of Commerce, for the opportunity afforded them of perusing Mr. Thwaites' letter, the Committee determine to draw up a brief memorandum of the best method of Hybridising (or crossing) Cotton: this will be submitted at the next Meeting and will be communicated to the Chamber of Commerce and the Board of Revenue; and also be published in extenso in the proceedings of the next Meeting of the Committee.

They also determine to make enquiry as to how far the results of the experiments in Cotton by Dr. Wight can be made known to, and useful to the public.

Read letter from the Right Hon'ble Lord Harris acknowledging the vote of thanks passed by the Committee in acknowledgment of his Lordship's constant interest in this Society.

Resolved, that under Regulation 5, the name of the Right Honorable Lord Harris be added to the list of extraordinary Members of the Society, and that his Lordship be duly informed of this resolution.

Read letter from R. D. Parker, Esq., resigning his seat on the Committee, in consequence of his final return to Europe.

This vacancy and those occasioned by the departure from Madras of S. D. Birch, Esq., and J. Young, Esq., and one other before existing, are proposed to be filled up by the nomination of the

following gentlemen who are to be solicited to join the Committee.

H. Fletcher, Esq.
Rev. J. R. Macfarlane.
Colonel Simpson.
A. M. Ritchie, Esq.

The Secretary intimates that Mr. Brown, the Superintendent is at present employed under the direction of the Hon'ble the Governor in the arrangements of the compound of Government House, Madras, and is to be similarly employed in the proposed PEOPLE'S PARK. The Committee approve of the foregoing.

Read the following—

Report of the Auditors of Accounts of the year 1858.

In conformity with the Resolution of the Committee of the 2d instant, we have examined the accounts of the Horticultural Society and beg to report as follows :

The Books submitted to us are a

General Cash Account.
The Subscription Book.
A Day or Bill Book.
The Bank Pass Book and sundry Vouchers.

We find the balance exhibited in the Bank Pass Book, corresponds with that shown in the general Cash Account, but there are several omissions in the Accounts to which we now advert. The following item is omitted in the credit side of the general Cash Account.

J. Goolden's subscription stated to be paid on the
23d August.............................. 14 0 0

The following items appear by the Day Book to have been paid, but are not credited in the general Cash Book.

In Sept.—Lieut. Playfair, under the head of *Seeds*. 29 8 0

Plants.

J. Vans Agnew, Esq.......................... 0 12 0

In October.

Seeds—Captain Holmes........................ 2 8 0
Do.—A. Christy, Esq.......................... 2 8 0

In November.

Seeds—Hon'ble W. Elliot	5	0	0
C. M. Teed Esq.,	5	0	0
Colonel McMahon	3	0	0

In December.

Seeds—C. M. Teed Esq.,	10	0	0
Hon'ble W. Elliot	2	0	0
Trees—J. Howell, Esq	1	8	0

In the general Cash Book, a number of items are credited for seeds and plants which have no corresponding entries in the Day Book.

By the Bank Pass Book it appears that the Cash balance at credit was in January, Rs. 1,162-3-2, whilst the balance in the general Cash Account is Rs. 1,031-8-2.

Again in July by the Bank's account, the balance at credit is shown to be 1,218-8-2, whereas in the general Cash Account, it is stated to be Rs. 1,127-8-2.

Further on the 31st December, the Cash balance at the Bank is stated to be 1,433-8-2, and the total credit balance including Cash in hand Rs. 1,615-4-10 instead of Rs. 1,629-4-10. The difference is perhaps to be accounted for by the omission of Mr. Goolden's subscription of 14 Rs. in August. The discrepancies above pointed out will probably be explained, and may arise from the imperfect system in which the accounts are kept; we may instance that no corresponding entries are made in the Books for payments or receipts from the Bank of Madras, the balance only being shown by a note at foot of the monthly statement in the general Cash Book.

We would therefore respectfully suggest,

1st. That a daily Cash Book be kept in which every transaction whether of payment or receipt be entered on its proper date—and that it be examined weekly by the Secretary and signed by him.

That the entries from this Book be posted into the General Ledger.

That an abstract of the monthly wages and petty disbursements be submitted to the Secretary and signed by him.

The Title Deeds of the Garden we would, in conclusion, suggest being deposited for safe custody with the Bank of Madras.

J. GOOLDEN,
ROBERT HUNTER.

Madras, February 15th, 1859.

Memorandum on Messrs. Goolden and Hunter's report on the accounts of the Agri-Horticultural Society, dated the 15th ultimo.

1st. Mr. Goolden's subscription paid on the 23rd August, was found to have been omitted when the accounts were summed up at the end of the year, and was entered into the Income account drawn up for the Secretary, but was not credited to the Society in the General Cash book, prior to its being sent for audit.

2. The accounts mentioned as paid, were in arrears at the end of December 1858, and were paid and marked so in the Bill Book in January, which will be seen by the Income account for that month.

R. BROWN, Superintendent.

Hort. Gardens, 8th March, 1859.

The Secretary intimates that he has examined the accounts and finds the foregoing strictly correct He also informs the meeting that since 1st January 1859, the accounts have been kept in the prescribed form and since examined by him and found correct. The accounts are now audited by him every week, and will be submitted to the monthly meeting of the Committee henceforward. This arrangement is approved.

The Title Deeds have been made over to the Secretary of the Madras Bank, whose acknowledgement is to be retained by the Secretary of the Society.

The Committee acknowledge with many thanks the receipt of a small packet of China Peas from Captain Proudfoot. These are to be sown in the gardens for experiment.

The following gentlemen are unanimously elected Members of the Society.

T. G. Clarke, Esq., R. Sladen, Esq., J. W. Mudge, Esq., A. H. Sullivan, Esq., C. S., T. Pritchard, Esq., and Captain Obbard.

Notice is to be given to all Members in, or near, Madras, that the Annual Meeting for the nomination of Office Bearers and to

receive the Report of the Committee, will take place on Friday July 15th, at 6 A. M. precisely. A full attendance of Members is earnestly solicited.

The following Members are to be constituted into a Sub-Committee to revise the rules and regulations and to prepare an Annual Report.

Hon. W. Elliot, Esq., Col. McCally, H. B. Montgomery, Esq., M. D.

The Secretary intimates that the Proceedings of the Society will be henceforward re-published in the Journal of the Madras Literary Society.

The next Meeting will be held on Wednesday 13th of July, when the Sub-Committee will present their Report for approval. Until further orders the Meetings of the Society are appointed to take place at 6 A. M.

WALTER ELLIOT, *Chairman.*
HOWARD B. MONTGOMERY, M. D., *Secretary.*

Annual Meeting of the Agricultural and Horticultural Society of Madras.

The Annual Meeting of the above Society was held on Friday the 22nd July 1859, and was attended by the following Members.

Sir Adam Bittleston, Kt.,
Colonel G. W. Y. Simpson,
Colonel R. Hamilton,
A. J. Scott, Esq., M. D.,
Dr. J. G. Shaw,
Dr. Mudge,
Captain Hope,
C. Dale, Esq.,
R. Hunter, Esq.,
Major Black,
Dr. Montgomery, *Secretary.*

(Before the opening of the Meeting, the Members present sat in Committee to examine the proposed rules which were slightly altered by them).

This having been done, it was proposed by Colonel Simpson and seconded by C. Dale, Esq., that Sir Adam Bittleston do take the Chair.

SIR ADAM BITTLESTON in the Chair.

The Secretary, in the unavoidable absence of the President of the Committee (Hon'ble W. Elliot, Esq.) read the following

Report of the Committee of the Agri-Horticultural Society for the year 1858, *and January to June* 1859.

The Committee have determined to resume the practice, formerly in force in this Society, by which an Annual Meeting should be convened to afford to all Members of it an opportunity of examining a record of its general working and management, and therefore beg to submit the following for your information.

On reviewing their proceedings, it is found that materials do not exist for a connected narrative of all that has been done, and therefore it has been determined to notice only the special subjects of interest under their several heads. The present report embraces all that has occurred between the 1st January 1858 and 30th June 1859.

General Management of the Society.—This has continued vested in the Committee in which several changes have occurred owing to the return to Europe of some of its Members. On the 5th of May 1858, Mr. Maclagan resigned the Secretaryship and was succeeded by Dr. Montgomery. The Committee desire to record their thanks to Mr. Maclagan for the ability with which he conducted the duties of his office.

Mr. Brown, who has been Superintendent since July 1857, and who was selected by Professor Balfour, of Edinburgh, has conducted himself to our entire satisfaction and displayed both zeal and ability in the discharge of his duties. The Gardens are kept most carefully and have much improved under his charge. Recently he has been also employed in the works connected with the improvements going on in Government House Compound and in the proposed People's Park. The Committee has approved of this arrangement which was sanctioned on the stipulation that it should not be allowed to interfere with his proper duties in the Garden.

The Committee cannot submit their Report without bringing prominently to notice the active and zealous exertions of their Secretary, Dr. Montgomery, by whom the general interests of the Society have been greatly benefited, more especially in the introduction of useful reforms and in bringing its objects more generally before the public.

Annual Exhibitions.—Two have taken place, one in February 1858, and one in February 1859. The former of these was successful and well attended by the Public. Before the Show of the present year, the Committee had submitted to them the desirability of preventing, as far as possible, the unnecessary crowding of the Garden, on these occasions, during the inspection of the Judges, and while the Members of the Society might desire to examine carefully the Flowers, Fruits and Vegetables exhibited. It was therefore resolved to issue admission tickets to Members and their friends, and to postpone the admission of the general public until after 12 o'clock.

Tickets were however freely distributed on that occasion to all persons, but henceforward the rules, on this point, which were passed last January, and which are now submitted for approval, will be enforced.

The last Exhibition was *unusually* successful owing to the active exertions of Colonel Colbeck, Mr. Maclagan, the Secretary, and the Superintendent to whom the thanks of the Committee and of the Society are due.

With reference to all future Exhibitions, the list of Prizes to be offered are to be prepared as long before as practicable. The Committee would suggest that at the meeting next succeeding each Annual Exhibition, the list of prizes and rules for the following year shall be determined on as far as possible. This has been already done as concerns the next Exhibition. The Regulations for *Visitors* and *Exhibitors* in the Show for 1860 are already in the possession of the Members of the Society. It is considered desirable that these Regulations shall be incorporated in the rules of the Society, so that all persons anxious to be informed on such points can be furnished with the required information in the same pamphlet which details the names of Members and the general regulations of the Society.

Proceedings of the Committee.—The Committee consisting of 12 Members with the President and Vice Presidents of the Society have continued to meet regularly once a month at the Gardens, in compliance with the resolution of the Annual Meeting of 1840, and the requisite publicity has been given to their Proceedings by the publication of them in the leading newspapers at the Presidency.

Arrangements were also made whereby copies of them in a separate form were procured and forwarded to all Members *gratis.* The Proceedings of the Society have also been included among those which it is proposed to insert in the Madras Journal of Literature and Science where they will find a permanent record of easy access.

It is hoped that the foregoing may be productive of increased interest on the part of the public in the working of the Society, and the Committee would receive with much pleasure for consideration at their Meetings any notes or papers treating of practical subjects or containing suggestions or facts relative to the cultivation of useful or ornamental plants.

Although it is not possible to recapitulate all the subjects which have engaged the attention of the Committee during the past 18 months, and which may be regarded as of *general interest*, yet they desire to allude more particularly to those points relative to the cultivation of Cotton which have come before them. Two tons of New Orleans Cotton seed, sent out to the Society by the Manchester Cotton Supply Association, were transferred to Government with the suggestion that quantities of seeds might be transferred *gratis* at Government expense to the Collectors of the several districts of the Presidency with a view to their being placed, without charge, at the disposal of any persons anxious to introduce the cultivation of this valuable species of exotic cotton. A pamphlet detailing the method of cultivation of it was also recommended to be published and widely circulated at Government expense. Both these recommendations have been approved by Government and are now being carried out. The Committee hope to have the pleasure of hereafter reporting favorably upon the result of the attempt, thus made, to naturalize one of the most productive species of this valuable plant. On this latter point, the Committee desire to refer to the very interesting letter contained in their Proceedings of the 15th of June in which Mr. Thwaites advocates that experiments should be made systematically of crossing the best kinds of native Cotton with "Bourbon," Sea Island" and "New Orleans'' Cotton. The Committee having given their full consideration to this suggestion consider it to be of a most valuable description and purpose republishing the letter alluded to, together with a memo-

randum of the best method of carrying it into effect, in the proceedings of the next monthly meeting to be held on the 3rd proximo.

Management of the Gardens.—During the period under notice, the Society's Garden has been much improved in general appearance and condition by a strict attention to its internal arrangements, and this without any increase in its fixed establishment, or current expenses. Additional walks have been made allowing of free access to every part of it. A quantity of brush wood has been removed from the bottom of the Tope, in the centre of the Garden, by which the circulation of air has been increased and the picturesque appearance of the Garden much enhanced. The hedges and shrubberies have been thinned and dressed. The old tank has been repaired and several ornamental shrubs planted on the Lawn. Gates have been erected at all the entrances to the Gardens, and the formation of a tree nursery has already been commenced. A new tank for the exhibition of Water flowers is now in course of construction and will probably prove a considerable attraction to visitors.

4 Specimens of the Manilla Hemp plant *(Musa Textilis)* have been successfully introduced. These were received from Col. Balfour, C. B., in February 1858. The plants are now 20 feet high and are thriving in every respect as vigorously as the common plantain. Many other useful and interesting plants have been introduced into the Gardens. Among these may be mentioned the true West India Ginger, roots of which were brought from Ceylon by Mr. Goldingham. Plants of these may be had on application to the Superintendent. The Sorghum brought to notice by Mr. Balfour was also grown successfully. The "Ife" *(Sansievera Cylindica)* forwarded by Sir W. Hooker, F. L. S., has also been successful.

Large collections of Australian Seeds have been presented by Colonel C. A. Browne and Colonel Lawford, and the collection of Orchis has been enriched by valuable contributions from Major General Johnson and others. A system of *Correspondence* is now being organized whereby a mutual interchange of plants can be effected.

Finances of the Society.—The accounts for the year 1858 have been submitted to the Auditors and been found by them to

be in a satisfactory state. The suggestions offered by the Auditors have been all complied with during the present year. The financial position of the Society may be regarded as slightly improving, and it is only to be regretted, that the limited number of Members does not give encouragement to any hope that its capital will be sufficiently augmented to allow of an extension of its operations or an increase of its public usefulness.

Number of Members.—On the 1st January 1858, there were 75 paying Members, and on the 30th June, this rose to 85. The Committee regard this increase as satisfactory, but would desire to bring prominently to the notice of the Members that the Gardens do not receive such general support as they are fairly entitled to. They are open at all times to the free use of the families of all persons, and the Committee hope that henceforward a larger amount of subscriptions will be made available. The allowance granted by Government is by no means sufficient to defray current expenses, and owing to the small number of Members, the gratuitous distribution of European vegetable, and Flower-seeds is not carried out on so liberal a scale, or to as many persons, as is desirable.

In conclusion, the Committee desire to submit copies of the regulations of the Society as amended at a recent meeting of the Managing Committee. The objects of their revision were the simplification of complicated and unnecessary regulations and the substitution of brief and clear rules for those formerly in force, and objectionable in length and want of perspicuity. The entrance fee is proposed to be abolished; the number of the Committee remains the same, but the offices of President and Vice-President are merged into the General Committee, who will from their own body select their own Chairman.

The present President and Vice-Presidents will join the Committee, and the three additional Members thus added will be gradually absorbed on the occurrence of vacancies.

The Patron and Vice-Patrons, who hold office, to a great degree, ex-officio, are requested to continue in their present position.

The Quarterly Meetings formerly ordered to be held are abolished, and the laws regarding exhibitions are incorporated in the laws of the Society.

This amended code of Regulations is now submitted for favourable consideration.

Proposed by Colonel Hamilton, and seconded by Dr. Shaw, that the foregoing Report be adopted, printed and circulated with a list of all Members and with the Regulations of the Society as revised and approved this day. *Carried unanimously.*

Proposed by Captain Hope, and seconded by Major Black, that the following gentlemen constitute the Committee for the year 1859-60, under the plan proposed in the Annual Report, and that Dr. Montgomery be requested to continue his services as Secretary. *Carried unanimously.*

The Hon'ble W. Elliot, Esq., G. S. Hooper, Esq., Lieut. Col. A. McCally, A. J. Arbuthnot, Esq., H. F. C. Cleghorn, Esq., M. D., Lieut. Col. H. Colbeck, C. Dale, Esq., J. Goolden, Esq., R. Hunter, Esq., A. J. Scott, Esq., M. D., J. D. Sim, Esq,, H. Fletcher, Esq., Rev. J. R. Macfarlane, Col. G. W. Y. Simpson, and A. M. Ritchie, Esq.

Proposed by Major Black and seconded by Dr. Mudge, that the thanks of the Meeting be offered to the Chairman for his obliging conduct in the chair.

A. BITTLESTON, *Chairman.*
H. B. MONTGOMERY, M. D., *Secy.*

Proceedings of a Meeting of the Committee held at the Gardens, on Wednesday, August 3rd, 1859.

PRESENT.

Hon. Walter Elliot, Esq.
Colonel Simpson.
Rev. J. R. Macfarlane, and
H. B. Montgomery, Esq., M. D., *Secretary.*

Dr. G. J. Shaw, *Visitor.*

The Committee unanimously nominate the Hon. Walter Elliot, Esq., to be Chairman, which office is accepted by that gentleman in whose absence, the Committee will elect a President for the day.

Read letter from Mr. A. T. Jaffrey, presenting Six Copies of the " Calendar of Operations," being No. 5 of his " Hints to Amateur Gardeners."

Resolved, that the thanks of the Society be conveyed to Mr. Jaffrey. This pamphlet promises to be useful to Gardeners, and gives in a convenient form the leading particulars necessary to the cultivation of the ordinary descriptions of European and Indian flowers, fruits and vegetables.

Read the following which has been placed at the disposal of the Society by Government.

Memorandum on the hybridizing of Cotton, &c.

As the improvement and increase of Cotton cultivation is occupying a prominent place amongst the passing events of the day, information from all available quarters will undoubtedly be sought for.

And as the theory of cross impregnating the variety cultivated in this country, with exotic varieties of Gossypium or (vice versa) has been brought under consideration a few practical remarks at the present junction may be useful.

It is well known to such as are acquainted with the Horticultural world that important advantages have been obtained by cross breeding, the amelioration of fruits, flowers and vegetables, in England and elsewhere has proved beyond a doubt that the vegetable kingdom is susceptible of receiving sexual impressions when the plants manipulated upon combine a versimilitude of structure, &c., that is to say when species of the same genera are acted upon such as cotton with cotton, apples with apples, &c.

Hybridizing is probably one of the most important items in Horticulture in a commercial point of view, and with all due deference to the suggestions of impregnating varieties of cotton for the purpose of improving the staple article of the country, and obtaining hardier varieties, a difference of opinion, it is trusted, will not be considered in the light of attempting to throw cold water upon the theory brought forth by them, no doubt cotton will receive sexual impressions equally with other genera and species in the vegetable kingdom, and could undoubtedly be multiplied into innumerable varieties. What could be accomplished, would no doubt be invaluable towards proving the affinity of different cot-

tons under cultivation in various parts of the world,—decided that the properties of the Native cotton could be improved by intermixture with exotic varieties, and that a quality of cotton was produced worth double the value of that cultivated at present. A query arises that requires an answer; have the qualities so produced become amalgamated with the structure and juices of the psuedo-variety so as to ensure a perpetuation of the improvement obtained.

The modes adopted to perpetuate the improved fruits and flowers, in other countries raise a doubt. In the generality of cases the seeds obtained from the improved varieties do not perpetuate the improvement—they either go back to the original or produce inferior sub-varieties, thus proving that the seed obtained from the impregnated plant alone conveys the change, and the only mode of keeping up the varieties obtained is by cuttings and grafts and such like operations. Upon this subject information is much wanted, herbs and vegetables have been improved and the improvement continues from carefully preserved seeds, but how or why the same does not in flowers or fruits remain in obscurity; drawing conclusions from what has been done by physiologists in investigating and eliciting information on the subject of cross-impregnation, a doubt as to the practicability of producing hardy or acclimatizing exotic varieties of cotton certainly exists, at least in so far as obtaining a permanent improvement; that cross-impregnation has been one of the triumphs of cultivation cannot be doubted, a trial of cotton might certainly be made. Science would be satisfied and an impulse given to commerce if an improvement which could be perpetuated was obtained on an article of so much value to England as cotton.

Whatever plan may be adopted towards the furtherance of increasing the value and cultivation of Cotton in India, the time has certainly arrived to steer by the "infallible compass of truth" hitherto the subject has had sufficiency of ideas expended whether they were foolish or wise; ideas that have not at any rate proved progressive towards the desired end.

Other plans might be adopted towards acclimatizing exotic varieties of Cotton, viz., growing the seed for a year or two on poor soil in a medium climate, seed might even be raised in Madras or

a similar climate, before cultivating it. One point connected with this subject has probably not been investigated, viz., has a field of native cotton while in flower and seed been carefully and scientifically examined. Observations taken as to whether there were not more than one variety in the field of a more robust habit, and producing better Cotton than the others, this matter is worthy of consideration, such occurrences are not unfrequent in the vegetable kingdom, and mayhap a superior variety is at the door, while traversing the universe for a better.

If impregnation is to be tried, a few words may not be out of place regarding the process which is exceedingly simple.

The greatest part of flowering plants have the sexual organs within their flowers. In the Nt. Ord. *Mavaceoe* to which Cotton belongs the male organs are attached to the style or female organ much care would be required in impregnating them, from the close proximity of the stamens to the stigma, and the short duration of the flowers, probably the safest way to proceed in this matter would be to open the flowers carefully before they are developed and remove the stamens with a pair of tweezers before they shed their pollen, after the flowers open the stigmas will require to be watched till they appear moist when the pollen from the variety (the properties of which are required) should be applied in sufficient quantity to cover the stigma completely. In order to prevent accident from bees or insects, each flower impregnated should be covered with a bag of muslin, or lace, and marked. The operation must be conducted in dry calm weather, notes should be carefully taken at the time as to the varieties used on the various plants acted upon. If the slightest amount of impregnation has taken place from the original pollen of the female used as the seed produce, there is no chance of success, the greatest care is necessary to prevent this and to cause a complete amalgamation of properties. It would be advisable to remove all the other flowers from the impregnative plant, but such as have been manipulated upon, so that every chance towards the production of a robust habit, and good seed, may be given, success may not be the invariable rule, though it is very likely to be obtained in a few cases, probably one or two good crosses—in one thousand plants, produced.

In conclusion the introduction of foreign seed is a work of time, and as hitherto proved of doubtful utility. Impregnation is more doubtful still, but the improved cultivation of the native cotton can go on at once, observations can be made if it does not contain improvable elements within itself, " *time is money*," and before a complete change could take place in the cultivation and acclimatizing new varieties, years will have passed away and it is very uncertain, if success would be attained at the end.

(Signed) A. T. JAFFREY.

In republishing the foregoing, the Committee do not think it necessary to enter upon the several questions and objections raised by Mr. Jaffrey. They consider the suggestion contained in Mr. Thwaites' letter worthy of a fair trial, and trust that it may be carried into practical effect, so as to test the points at issue fully and satisfactorily.

Too great care cannot be taken, however, in guarding against the possibility of the style being fertilized by the pollen of its own stamens and to prevent this, the latter should be removed before the full development of the flower. The pollen which it is desired to transfer to the style of the inferior variety can be easily shaken off from the stamens of the better plant, if these are removed " en masse" on the perfection of the flower to which they belong. The New Orleans Cotton may be seen growing in the Gardens and the perfect flowers examined by Visitors.

The Committee republish the following on the object to be attained by hybridizing Cotton.

Paradenia, Ceylon, 24th March, 1859,

My dear Sir,—I am glad to hear that a decided effort is to be made to give an impetus to an extensive cultivation of Cotton, for the English Market in the Madras Presidency, and I trust it will be attended with every wished-for success.

It has occurred to me, as there would probably be some difficulty in getting the superior descriptions of American Cotton acclimated in any moderate space of time, that attempts to improve the Native Cotton are well worthy of consideration, and I would suggest that systematic experiments should be made of crossing the Native kinds with the " Bourbon," " Sea Island," and " New

Orleans" varieties. In conducting the operation, the same plan should be adopted and the same precautions observed that are taken in crossing valuable flowers and fruits, with such signal success, in Europe. An intelligent, active and conscientious person should be employed, who would give the experiment a fair trial, for if the result should be the obtaining a variety of cotton—hardy, prolific and of the superior staple, the benefit would be almost incalculable, whilst if the experiment should not end in so favourable a manner as could be desired, a problem of very great interest would have been solved, as to the affinity the several varieties of cotton bear to one another.

The following is the plan I should recommend being adopted in carrying out the experiment.

A moderate number of each of the several varieties of superior Cotton should be planted and carefully cultivated, each kind being kept separate. The Native Cotton should be planted in a certain number of rows, and of so many of these rows all the plants should have their flowers crossed by one description of superior Cotton ;—the plants of so many other rows by another description of superior Cotton, and so on :—and each flower, when crossed, might be marked by a small piece of coloured twine being tied to its stalk.

The ripe seeds obtained from these crossed flowers should be sown in distinct patches,—that is to say—those resulting from the cross with the "Bourbon" in one place, those from the "New Orleans" in another, and so on for the rest.

When the plants raised from these seeds come into bearing, a great diversity would probably be exhibited by them, respectively, as regards healthy appearance, prolificness and the quality of the staple. The inferior ones should be pulled up and thrown away, and the better kinds retained and numbered, and their comparative qualities well examined and recorded.

If it should be found that real progress had been made towards improvement of the Native Cotton, the system of crossing might be still further carried on, using the plants of the already improved stock, instead of those of the original Native kind, for crossing upon : and this operation might be carried on for several genera-

tions of plants until the maximum improvement should be considered to have been realised.

Believe me, &c.,

(Signed) G. H. THWAITES.

Any person desirous of making experiments as suggested above may obtain from the Gardens a small supply of the New Orleans Cotton seed. And the Committee would feel obliged by any detailed accounts of such experiments for publication in their proceedings.

The following directions in Mr. Thwaites and Mr. Jaffrey's letters must be carefully observed in carrying out the systematic hybridzing of Native Cotton.

The Committee desire to acknowledge the receipt from Dr. Mudge of a packet of seeds said to belong to a " bright yellow Showy Creeper from the woods of Newara Ellia." Some other seeds, under Dr. Mudge's care, have produced healthy plants, which have not, however yet flowered.

Resolved, to send some of the seeds now received to the Laul Baugh Gardens, Bangalore, where Mr. New is requested to give them a fair trial. Some seeds will also be forwarded to Utacamand (Ootacamund) to Mr. McIvor. The seeds seem to belong to a species of Crotolaria, but it is feared that they may not be well suited to this climate as the place from which they have been brought is considerably above the level of the sea.

The monthly accounts are submitted and approved.

The following Gentlemen are elected Members of the Society with effect from 1st July.

Amir Ud Dowlah, Major Lawder, 44th Regt. N. I., Rev. P. Percival, F. B. Maloney, Esq., C. S. and Major Orr.

The next Meeting will be held on Wednesday the 7th September, at 6 A. M., at the Gardens when the attendance of Members as visitors is requested.

WALTER ELLIOT, *Chairman.*

H. B. MONTGOMERY, M. D., *Secretary.*

Proceedings of a Meeting of the Committee held on Wednesday, 7th September 1859.

PRESENT.

Sir Adam Bittleston, *Vice Patron.*

G. S. Hooper, Esq., *President.*

Colonel Reid, C. B.
Colonel Simpson.
J. Goolden, Esq.
C. Dale, Esq.
H. B. Montgomery, Esq., M. D., *Secretary.*

Amir Ud Dowlah, Bahadoor, attended as a visitor.

In the absence of the Hon'ble Walter Elliot, Esq., Mr. Hooper is elected President of the day.

The Secretary intimates that on 12th ultimo, he forwarded to the Revenue Board 50 copies of the Proceedings of the last meeting, suggesting that they might with advantage be circulated to the various Collectors in the Presidency, and re-published in the several local *Gazettes.*

Read.—With reference to the foregoing the following

No. 3206.

Proceedings of the Board of Revenue, dated 16th August 1859.

Read letter from the Secretary to the Agri-Horticultural Society, Madras, dated 12th August 1859.

(In Con. 12th August 1859, No. 4034.)

The Board fully concur in the suggestion of the Committee of the Horticultural Society, and resolve to forward the papers received to the different Collectors with instructions to publish them in several issues of their Gazettes, in the Vernaculars as well as in English.

2. The Board will be happy to give similar publicity to any valuable papers with which the Committee may from time to time favor them.

(A True Extract.)

(Signed) J. D. SIM, *Secretary.*

Read application from the Church Committee at Vepery requesting a collection of shrubs and plants for the Vepery and Pursewakum Burial Ground.

Resolved, that the foregoing be complied with without charge as the purpose may be esteemed a public one.

The Secretary submits papers showing the disposal of the vegetable seeds received in July. By these it appears that all Members have received one packet of seeds, and those remaining have been disposed of.

The second supply of vegetable seeds and a consignment of flower seeds were received by last mail, and these will be distributed to Members in a few days.

Several applications already received from private persons will be then complied with, and any person anxious to purchase packets of seeds can do so. Each packet of seeds is sold at 5 Rupees.

As the Flower seeds received are slightly different from those ordered, the Committee direct the publication of the following List of

Mignionette.
Balsam (fine mixed.)
Phlox Drummondii (Var.)
Carnation (mixed.)
Colliopsis.
Anterrhinum.
Petunea.
Sweet Peas.
Scarlet Geranium.
French Marygold.
Mesembryanthemum.
Nasturtions.
Maurandya.
Portulaceæ.
Holly hock.
Lophospermum Scandens.
Browallia alata.
Brachycome (mixed.)
Ænothera.
Larkspur (mixed.)
Indian Pink.
Nalana Prostrata (mixed.)
Helichrysum Bracteatum.
Viscoria Oculata.
Martynia fragrans.
Sanvitatia Procumbens.
Erysium perowskianum.
Cyanus (new varieties.)
Zinia elegans (do.)
Salvia (mixed.)
Lobelia (mixed.)

A supply of seeds from Bangalore has been ordered and its receipt and varieties included in it will be notified in due course.

The Committee have to acknowledge with thanks the receipt of two packets of seeds from Dr. Cleghorn. One contains white Holly hock, Spanish Broom, Lophospermum, Chickrassia tabularis: the other, Indigofera, Pulchella. Swaensonia, Satinwood, Chittagongwood, Mauramday Barclayana, Coonoor Orange (fine variety.)

The following Gentlemen are unanimously elected Members of the Society.

C. Pelly, Esq., C. S.

W. B. Hulhed, Esq.

Amir Ud Dowlah kindly offered to place at the disposal of the Committee any fruit trees which they might desire.

The Chairman expressed his sense of the courtesy of this offer of which the Committee will gladly avail themselves.

The next Meeting is appointed to be held on Wednesday October 5th, when any Member wishing to attend is invited to do so.

G. S. HOOPER, *President.*

H. B. MONTGOMERY, M. D., *Secretary.*

DAILY MEANS.

APRIL 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·915	83·3	76·1	90·7	80·2	N E	....	Hazy
2				91·8	80·3	E N E	0·030	
3	·908	83·1	77·2	91·3	80·8	E N E	·245	Clody
4	·889	82·7	77·5	91·1	78·9	E	....	do
5	·897	85·2	78·9	95·5	81·1	E S E	...	do
6	·889	85·6	79·1	94·8	81·0	E S E	....	do
7	·887	85·0	78·5	94·1	80·4	?	....	do
8	·879	85·1	78·4	93·4	80·8	S E	....	Hazy
9				93·8	80·4	S S E	....	
10	·900	84·2	77·6	94·7	78·4	S E	....	Clody.
11	·880	85·4	79·3	94·9	80·0	S S E	....	Hazy
12	·848	85·5	79·6	94·7	80·2	S S E	....	do
13	·857	85·9	78·7	97·3	80·6	?	....	do
14	·869	85·2	78·6	94·8	79·4	S E	....	Clear.
15	·888	84·8	78·0	94·6	78·6	S E	....	do
16				94·8	79·4	S S E	....	
17	·818	85·2	78·4	94·5	80·0	S B E	....	Hazy
18	·788	85·7	78·7	96·6	80·0	S B E	....	Clody.
19	·810	85·9	78·7	94·9	81·0	S S E	....	do
20	·815	84·2	77·2	95·0	77·4	S E	..	Hazy
21	·802	84·3	76·0	96·3	77·3	E	....	do
22	·803	83·0	77·2	87·9	81·1	E N E	·040	Ovcst.
23				84·2	77·4	?	3·766	
24	·772	82·4	77·7	88·6	80·1	S E	0·082	do
25	·772	81·3	77·4	91·1	78·7	S	·381	do
26	·804	81·8	77·8	89·6	80·2	S S E	·075	do
27	·836	83·6	79·2	91·1	81·0	S	·300	do
28	·849	83·8	79·0	91·4	81·3	S B E	....	do
29	·846	84·1	78·7	95·0	78·5	S B W	....	Hazy
30				96·3	79·2	?	....	
31							....	
Means	29·850	84·3	78·1	93·2	79·8		4·919 Sum	

MAY 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·872	85·4	79·3	94·3	81·0	S E	....	Clear.
2	·859	86·0	79·6	98·6	80·5	S	....	do
3	·834	86·8	80·2	100·0	80·3	S B E	....	do
4	·803	86·3	80·7	96·6	82·5	S E	....	do
5	·809	86·6	81·0	94·8	82·8	S B E	0.008	Hazy
6	·793	86·4	79·5	98·6	79·3	?	....	do
7				96·5	82·0	S S E	....	
8	·802	87·7	80·7	101·8	83·2	S S E	....	Clear
9	·801	89·9	80·8	106·6	83·4	S B W	....	do
10	·756	89·5	80·4	104·7	83·1	S S E	....	do
11	·714	88·8	81·0	99·5	83·0	S S W	....	do
12	·717	87·8	81·9	97·7	83·2	S S E	....	Hazy
13	·749	87·3	82·0	95·9	83·3	S B E	....	do
14				98·5	78·2	?	·100	
15	·760	86·9	81·2	97·1	81·1	S B E	....	Clear.
16	·753	86·9	81·7	95·0	82·5	S S E	....	do
17	·789	86·5	81·2	95·0	82·4	S S E	....	do
18	·794	86·8	80·4	95·6	82·7	S	....	do
19	·751	86·8	80·7	96·4	81·8	S S E	....	do
20	·723	88·5	80·4	103·9	82·2	S	....	do
21				102·7	83·8	S S E	....	
22	·748	86·5	79·6	94·7	75·5	S S W	·745	Hazy
23	·755	86·8	80·9	97·3	82·7	S	....	Clody.
24	·735	86·7	79·8	96·3	81·6	S B E	....	Hazy.
25	·749	87·2	80·0	98·9	83·2	E S E	....	Clody
26	·769	87·1	80·3	96·3	83·0	S E	....	Hazy.
27	·774	87·2	80·9	96·1	83·3	S S E	....	do
28				101·6	83·3	?	....	
29	·696	88·9	80·4	102·8	82·3	W S W	. ..	do
30	·656	89·4	79·9	102·2	83·4	S S W	....	Clear
31	·635	89·9	80·0	102·9	84·0	S W	...	do
Means	29·763	87·3	80·5	98·7	82·1		0·853 Sum	

JUNE 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·618	90·1	80·5	103·4	84·8	S	....	Hazy
2	·681	90·2	78·4	103·0	85·9	?	. ..	Ovcst.
3	·717	88·9	78·9	102·4	84·5	?	....	Clody.
4				103·3	79·2	W B S	0·122	
5	·702	88·1	79·4	101·8	79·0	W	·518	Ovcst.
6	·725	88·1	79·7	102·8	83·2	S W	·003	Clody.
7	·704	88·0	80·0	99·6	82·3	S S W	·068	do
8	·683	86·4	79·0	95·8	82·7	?	....	Ovcst.
9	·680	85·3	79·0	96·8	80·0	S S E	·970	do
10	·685	85·5	79·0	95·8	81·6	S W	·020	do
11				96·2	80·2	S S W	....	
12	·682	84·8	78·0	97·6	79·9	W S W	·031	do
13	·707	86·6	77·8	97·0	81·9	S W	....	do
14	·733	87·0	77·1	100·1	80·7	S W	....	do
15	·762	88·5	76·7	100·0	82·1	W B S	....	Clody.
16	·775	86·9	77·7	102·7	80·7	S S W	·073	do
17	·776	88·6	78·3	103·2	83·1	S S W	·033	do
18				103·2	82·3	W S W	·144	
19	·747	86·2	77·3	102·4	79·1	S W	·282	Ovcst.
20	·758	85·2	77·4	101·0	79·2	S	·241	Clody.
21	·798	84·0	77·6	98·1	78·9	S S W	·006	Ovcst.
22	·796	85·2	78·4	99·0	80·3	S	...	Clody.
23	·777	86·1	77·9	101·2	80·0	S B W	....	do
24	·766	87·1	78·1	100·5	81·1	S	....	Hazy
25				102·2	82·1	S B W	....	
26	·782	87·0	78·9	103·1	82·4	S S W	....	do
27	·774	86·6	77·7	103·0	80·9	?	·003	Ovcst.
28	·748	87·3	78·1	100·8	82·0	S S W	....	Hazy
29	·735	88·0	78·7	98·7	82·5	S W	....	do
30	·747	86·2	78·9	95·1	81·9	W S W	....	Clody.
31							...	
Means	29·733	87·0	78·4	100·3	81·5		2·514 Sum	

JULY 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·765	85·2	78·5	98·1	80·9	S S W	....	Hazy
2				96·2	82·5	S E	....	
3	·772	86·5	79·6	97·1	81·8	S B W	...	do
4	·810	86·8	79·1	96·3	81·1	S B E	....	do
5	·794	86·9	79·3	95·5	81·5	S B W	....	Clear.
6	·740	86·7	79·7	97·1	81·7	S	....	Hazy
7	·704	87·7	80·4	98·5	82·1	S B E	...	do
8	·701	87·6	80·1	97·6	82·8	S S W	...	do
9				99·1	82·2	?	....	
10	·694	86·7	79·2	95·0	81·2	N N E	....	do
11	·684	82·1	77·8	87·7	77·7	N N W	2·057	Ovcst
12	·638	78·7	75·6	88·6	75·3	N N E	3·400	do
13	·638	82·5	79·1	93·2	78·9	S	0·015	Clody.
14	·690	82·8	78·4	96·2	78·2	W B S	·482	do
15	·689	82·9	78·3	92·1	80·1	S S W	....	Ovcst.
16				84·1	77·5	W	·560	
17	·719	80·5	77·1	85·1	78·1	W S W	·011	do
18	·768	80·6	75·9	91·7	77·5	W B S	·013	do
19	·732	83·2	77·1	95·1	78·3	W S W	·002	do
20	·691	83·2	76·7	92·7	80·2	W S W	·068	do
21	·685	83·0	76·6	93·4	79·1	W S W	·150	do
22	·730	82·1	76·5	95·0	78·0	W B S	·070	do
23				97·7	79·1	W B S	...	
24	·701	85·0	76·6	96·6	80·6	N B W	....	do
25	·681	86·4	76·1	99·2	81·5	W	....	Clody.
26	·703	87·6	76·4	100·3	80·8	W	....	do
27	·721	88·8	76·8	100·6	82·2	W	....	do
28	·731	88·4	76·2	100·1	82·7	W	....	do
29	·730	87·4	78·1	101·1	81·6	S W	·270	do
30				98·7	81·6	S S E	·045	
31	·749	86·0	78·6	98·3	81·8	S S W	....	do
Means	29·718	84·8	77·8	95·4	80·3		8·044 Sum	

AUGUST 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·815	85·7	79·7	95·9	81·1	S S E	0·013	Clody.
2	·830	85·1	79·6	93·5	82·5	S E	·849	do
3	·842	82·0	78·0	91·9	76·6	W S W	·123	Ovcst.
4	·831	82·6	78·6	93·8	80·2	S S W	....	Clody.
5	·824	85·0	79·8	96·0	79·8	W B S	....	Hazy
6				97·1	80·7	S	....	
7	·856	84·6	79·2	93·8	79·7	S B E	....	do
8	·860	84·0	78·1	94·1	79·7	S	....	do
9	·828	85·0	78·7	98·9	79·9	S	....	do
10	·807	83·9	77·7	92·4	80·2	?	....	do
11	·788	84·8	78·5	95·2	79·5	S S W	....	Ovcst.
12	·769	83·5	77·6	94·7	78·4	W S W	....	do
13				91·7	78·1	?	....	
14	·758	83·1	77·4	95·3	79·9	S S W	·016	Clody.
15	·748	83·0	77·1	96·3	78·3	W S W	·027	do
16	·705	83·2	77·6	94·2	77·2	W	·080	do
17	·666	83·9	77·5	95·3	80·5	W N W	·385	Ovcst.
18	·676	80·9	76·7	88·9	79·1	W N W	·004	do
19	·732	80·2	76·8	81·5	79·6	N W	·113	do
20				95·2	77·6	N W	·008	
21	·714	81·4	77·0	92·3	79·1	N B W	·229	do
22	·703	83·1	77·2	92·8	78·9	?	....	do
23	·726	84·6	76·7	94·2	80·4	W B S	....	do
24	·743	84·7	76·5	96·3	80·8	W S W	·002	do
25	·735	85·4	76·7	96·5	80·0	W S W	....	do
26	·762	85·5	78·0	99·4	79·9	S S W	....	do
27				96·4	81·5	S W	....	
28	·764	85·7	77·5	98·3	81·0	?	....	Clody.
29	·765	85·0	77·8	97·3	80·0	W B S	·280	Hazy
30	·746	85·0	77·3	98·0	79·8	W B N	·128	Ovcst.
31	·703	82·9	76·6	92·4	80·0	W N W	·209	do
Means	29·766	83·8	77·8	94·6	79·7		2·457 Sum	

SEPTEMBER 1859.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·738	84·0	76·6	97·6	79·2	?	0·095	Clody.
2	·770	85·2	77·3	98·3	79·9	S S W	....	do
3				98·3	79·4	W B N	·035	
4	·769	86·4	77·1	99·4	80·1	W S W	·002	do
5	·777	85·0	77·7	97·7	81·0	N N E	·035	Ovcst.
6	·796	86·6	77·7	100·7	82·0	S S W	·003	Clody.
7	·806	86·8	78·0	99·2	81·0	S S W	....	do
8	·784	85·9	77·8	97·0	81·5	S S W	·045	do
9	·785	86·6	78·1	98·4	81·8	W S W	...	do
10				94·9	78·3	S S E	1·388	
11	·833	84·8	79·7	91·2	81·6	S S E	.. .	do
12	·825	84·5	79·1	97·8	79·3	S S E	....	do
13	·779	85·1	78·8	99·5	79·4	S	0·389	do
14	·777	81·0	76·2	94·5	76·0	?	1·283	Ovcst.
15	·776	81·7	77·0	96·2	77·3	S W	0·046	do
16	·786	83·9	77·9	96·8	80·1	S W	....	Clody.
17				94·4	81·3	S	....	
18	·813	84·8	78·4	93·5	79·8	S S E	....	Hazy
19	·843	84·3	77·7	97·5	77·8	S W	·159	Clody.
20	·842	84·4	79·3	92·2	80·8	E S E	....	Hazy.
21	·858	83·5	78·0	92·0	79·0	S S E	....	do
22	·843	83·7	78·0	91·7	79·4	S E	....	do
23	·831	84·0	78·7	92·8	80·0	S B E	. ..	do
24				92·4	70·9	S E	....	
25	·84[illegible]	82·9	78·6	90·2	80·1	E B N	·165	do
26	·845	80·6	77·2	85·0	78·9	E	·608	do
27	·791	77·7	75·7	82·0	76·1	N E	3·447	Ovcst.
28	·777	7·1	75·4	81·2	75·3	N N E	0·753	do
29	·791	[illegible]	75·6	88·3	75·0	?	....	Clody.
30	·791	8[illegible]7	77·3	92·2	77·5	W N W	·104	Ovcst.
31							....	
Means	29·803	83·4	[illegible]·77	94·1	79·3		8·559 Sum	

? This mark signifies that no means can be taken owing to the variable state of he wind.

HOURLY MEANS.

Gottingen Mean Time.	Noon.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Means
Madras Mean Time.	h. m. 4 41	h. m. 5 41	h. m. 6 41	h. m. 7 41	h. m. 8 41	h. m. 9 41	h. m. 10 41	h. m. 11 41	h. m. 12 41	h. m. 13 41	h. m. 14 41	h. m. 15 41	h. m. 16 41	h. m. 17 41	h. m. 18 41	h. m. 19 41	h. m. 20 41	h. m. 21 41	h. m. 22 41	h. m. 23 41	h. m. 0 41	h. m. 1 41	h. m. 2 41	h. m. 3 41	
Bar. at 32° Far. 1859	In.	In.	In.	In.	In.	In.	In.	In.	In.	* In.	In.	* In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Apr.	29·792	29·805	29·826	29·849	29·871	29·884	29·884	29·874	29·858	29·840	29·828	29·823	29·830	29·845	29·866	29·892	29·905	29·906	29·896	29·876	29·846	29·819	29·800	29·787	29·850
May.	·701	·718	·737	·758	·778	·794	·797	·788	·775	·760	·749	·747	·766	·770	·789	·805	·815	·810	·797	·780	·754	·729	·703	·688	·763
June	·671	·682	·700	·723	·744	·757	·762	·754	·742	·726	·715	·715	·724	·738	·758	·774	·785	·784	·773	·756	·732	·711	·688	·677	·733
July.	·654	·666	·688	·710	·729	·745	·752	·745	·734	·719	·709	·705	·708	·720	·739	·754	·766	·762	·752	·736	·715	·693	·670	·657	·718
Aug.	·699	·711	·730	·758	·780	·797	·802	·792	·778	·765	·754	·752	·755	·769	·787	·808	·821	·822	·808	·789	·764	·736	·714	·709	·766
Sep.	·735	·748	·769	·793	·817	·832	·834	·822	·804	·792	·785	·785	·797	·816	·836	·856	·867	·867	·854	·827	·795	·764	·739	·730	·803
Dry Ther. 1859	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Apr.	86·5	85·2	84·0	83·5	83·0	82·6	82·2	81·6	81·1	80·6	80·1	79·6	79·1	78·8	80·7	83·9	86·2	88·0	89·2	89·7	90·0	89·3	88·9	88·1	84·3
May.	90·3	87·8	86·2	85·5	85·1	84·7	84·3	84·0	83·5	82·9	82·3	82·0	81·6	81·3	83·8	83·4	89·9	92·3	94·0	94·9	94·9	94·2	93·5	92·3	87·3
June	90·5	88·2	86·2	85·5	84·9	84·4	84·1	83·6	83·1	82·3	81·5	81·2	80·8	80·5	82·3	85·2	88·2	90·7	92·3	94·0	95·2	95·7	94·5	93·2	87·0
July.	89·1	87·2	85·2	84·2	83·3	82·5	82·1	81·7	81·3	80·8	80·4	80·0	79·5	79·2	80·6	82·7	85·1	87·3	89·1	90·0	91·0	91·5	90·8	90·4	84·8
Aug.	87·6	85·7	84·1	83·2	82·2	82·0	81·6	81·2	80·6	80·3	80·0	79·6	79·2	78·9	79·9	82·0	83·8	85·7	87·4	88·7	89·9	89·8	89·8	89·2	83·8
Sep.	86·1	84·3	83·3	82·5	81·9	81·4	80·9	80·3	79·9	79·6	79·4	79·1	78·7	78·5	79·4	81·6	84·0	86·0	87·8	89·0	90·0	90·5	89·8	88·4	83·4
Wet Ther. 1859	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Apr.	78·9	78·6	78·1	77·9	77·8	77·7	77·6	77·4	77·2	77·1	76·9	76·8	76·6	76·4	77·1	78·2	78·8	79·2	79·6	79·7	79·7	79·5	79·5	79·3	78·1
May.	81·6	81·2	80·9	80·9	80·9	80·9	80·7	80·5	80·1	79·7	79·3	79·1	78·8	78·2	78·8	79·6	80·2	81·0	81·3	81·6	81·8	81·9	82·2	81·9	80·5
June	80·0	79·5	79·2	79·2	79·0	78·8	78·7	78·4	77·8	77·5	77·2	77·0	76·7	76·2	76·4	77·5	78·0	78·3	78·5	78·8	79·2	79·7	80·1	80·0	78·4
July.	79·5	79·1	78·5	78·2	77·9	77·5	77·4	77·2	77·0	76·8	76·6	76·4	76·1	75·5	75·9	76·6	77·3	78·1	78·7	79·1	79·6	79·7	79·7	79·6	77·8
Aug.	79·2	79·0	78·6	78·4	78·0	77·8	77·6	77·4	77·2	77·0	76·9	76·7	76·4	75·8	75·6	76·6	77·1	77·7	77·9	78·3	78·8	79·4	79·6	79·4	77·8
Sep.	78·4	78·2	78·1	77·9	77·9	77·9	77·6	77·4	77·2	77·0	76·9	76·5	76·1	75·8	75·9	76·5	77·2	77·8	78·4	78·5	78·8	79·0	79·5	79·1	77·7

* The numbers in these columns are not observed but interpolated for the sake of obtaining the daily means.

MADRAS OBSERVATORY:
March 1860.

J. F. TENNANT, Major, B. E.
Government Astronomer.